JULY · 1957
PRICE 40 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

Flexibility *for expansion in electrical design and new floodlighting methods are features of 15-acre manufacturing center.* page 87

BUSWAY AND NM cable are combined in novel distribution system for suburban discount department store project.

page 94

ESTIMATING FORUM—first of a new series of articles by Ray Ashley.

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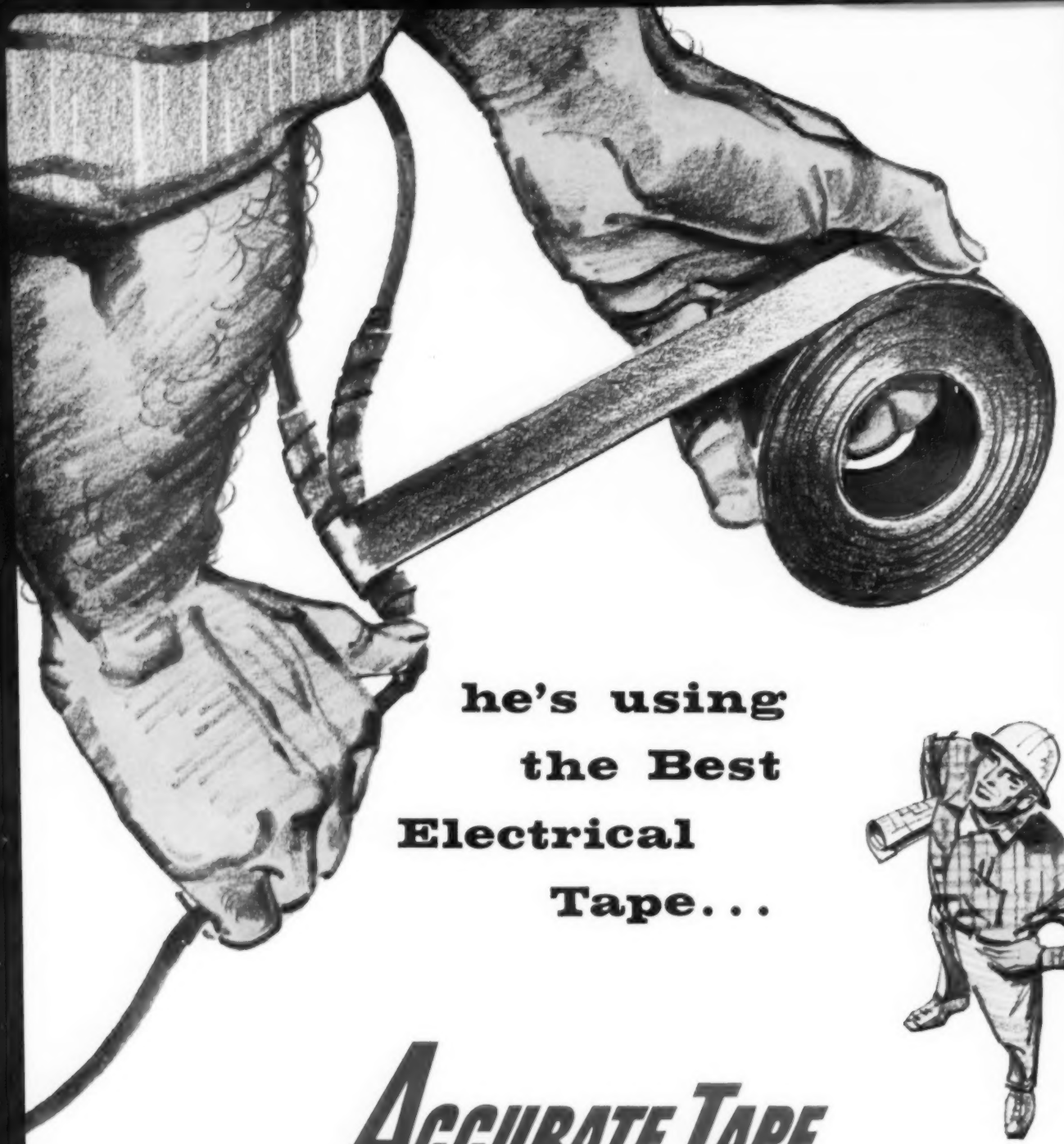
A McGRAW-HILL PUBLICATION 56TH YEAR



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Basic Starter Mechanism

DESIGN LEADERSHIP IN THESE FEATURES:

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- ✓ Single or double pole construction
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- ✓ Definite trip indication
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- ✓ Open type starter can be used with standard switch box and flushplate

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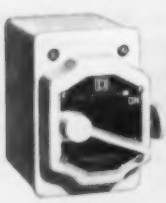
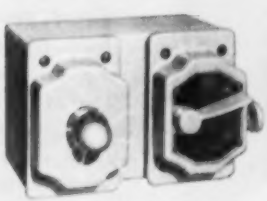
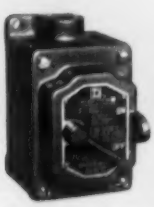


Water-tight and **dust-tight** enclosure



Water-tight and **dust-tight** with pilot light



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Flush mounting. Basic starter mechanism can be used with standard switchbox and flush plate — or with flush plate only for machine tool cavity mounting.

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1 H.P., 115-230 volts A.C. or D.C.

Single pole
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SQUARE D COMPANY

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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Sidelights

CONTROL REPRINTS–A limited number of reprints of "Electric Controls", a 50-page special editorial feature section from our May issue, are now available. The original and unique project, by Engineering Editor J. F. McPartland, has aroused wide interest throughout the industry because it covers not only the operation and selection of controls for practical applications, but coordinates these data with installation and circuit layouts together with the applicable Code requirements. One major electric control manufacturer is already using the article as a text for a training program. To save your own May issue, why not order reprints for all your key personnel? The price is 75 cents a copy.

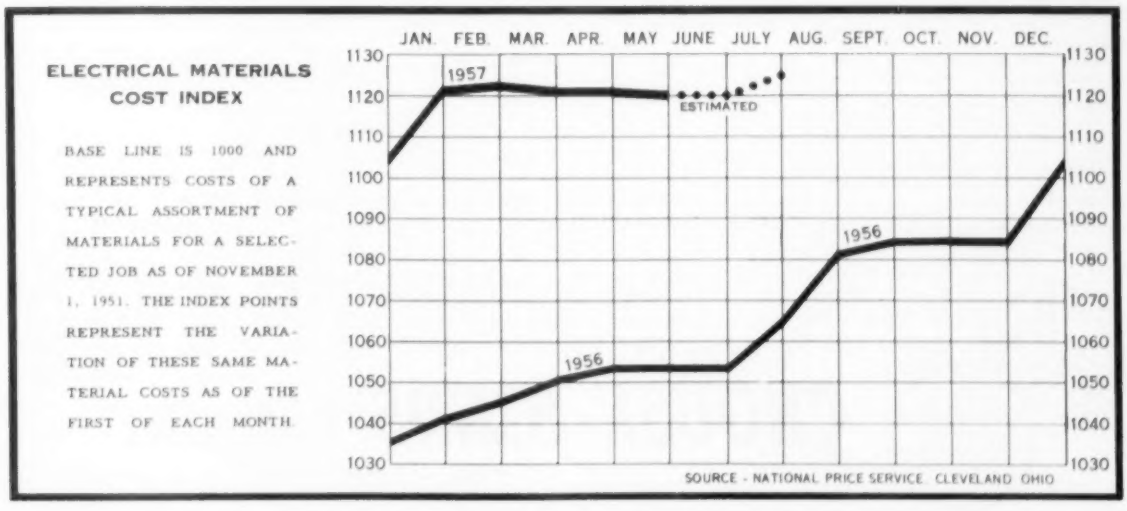
ESTIMATING–Ray Ashley begins a new series with this issue devoted to the basic elements of accurate estimating. He discusses the four principal divisions of costs that must be included in every estimate; material, labor, direct job costs, and overhead. See "Estimating Forum", page 99.

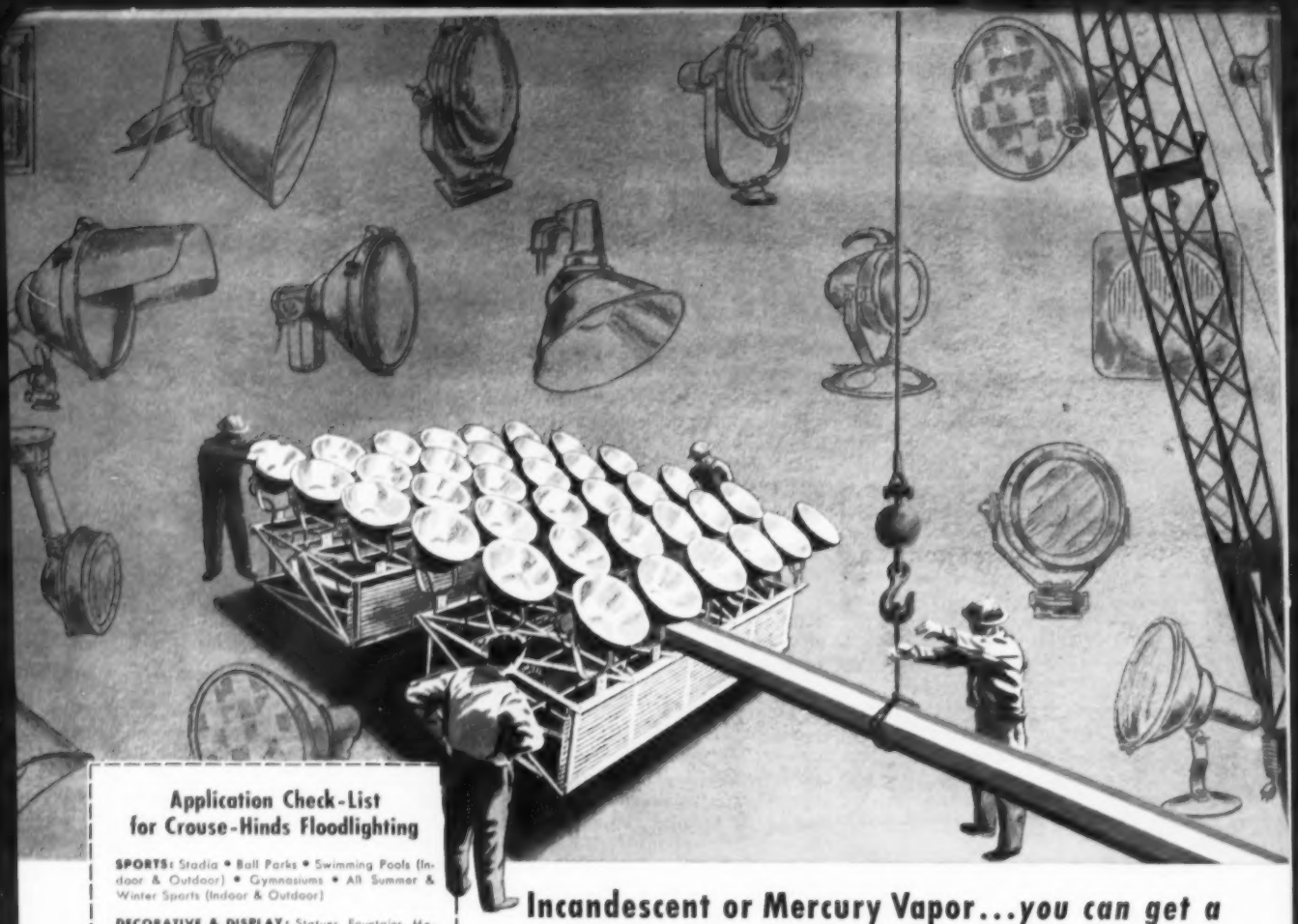
FIELD BENDS–Modern hydraulic conduit benders have made an important contribution to job standards and installation practice. A case study of field bending practice with "one-shot" equipment, which produces 90-degree bends with one setting, is described by Dietz Electric Co. of Milwaukee, Wis. in connection with an $8 million hospital project. Substantial savings are reported. See "It Pays to Field-Bend Conduit" beginning on page 106.

ELECTRIC CEILINGS–Selling complete integrated electric is prime business for the electrical contractor and a sound bargain for the customer, according to Robert E. Walton, vice president of Sweney Electric Co. in Gary, Ind. Five years ago the company started to build electric ceiling business by installing a trans-lighted ceiling in an auto showroom. Since then electric ceiling work has "snowballed" into an important specialty. Mr. Walton describes his company's experience and discusses the details of a typical installation in "There's No Ceiling on Ceiling Work", page 104.

REMOTE CONTROL–A brief rundown on the sizing, protection and hookup of circuits for remote control devices is presented on page 118. This article presents the major requirements of the National Electrical Code for circuits to operating coils of relays, magnetic contactors, remote control switches and motor starters. The information is digested as a handy reference source on design considerations for all types of remote control circuits. A full and thorough understanding of this data is essential to proper application and installation of equipment used in today's rapidly developing trend toward remote control of power and lighting loads.

STORE WIRING–Not too many years ago, the use of busway for horizontal distribution in a store would have been considered radical design. But today–with the sweeping imagination of modern design engineering–use of busway distribution in a highway department store like Modell's Shoppers World, Lodi, N. J., is clearly a sound, economical application. The story of this installation starts on page 94. There Arthur Reichel, the design engineer, covers the "how's" and "why's" of the busway distribution and details the use of type NM cable for branch circuiting. The safety, economy and efficiency of this combination busway-NM cable system indicate the wide diversity of system design possible with today's materials.


ELECTRICAL MATERIALS COST INDEX
BASE LINE IS 1000 AND REPRESENTS COSTS OF A TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. THE INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1130
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
1957
ESTIMATED
1956
1956
SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



Application Check-List for Crouse-Hinds Floodlighting

SPORTS: Stadia • Ball Parks • Swimming Pools (Indoor & Outdoor) • Gymnasiums • All Summer & Winter Sports (Indoor & Outdoor)

DECORATIVE & DISPLAY: Statues, Fountains, Memorials & Monuments • Public Gardens • Building Fronts & Entrances • Park, Playground & Cemetery Entrances & Interiors

BUSINESS: Shopping Areas • Drive-Ins, Outdoor Theaters • Building Fronts & Entrances • Recreation Parks • Gas Stations

AIRPORT: Ramps • Boarding & Loading • Street & Road Approaches to Airport • Markers & Beacons • Emergency Portables

CONSTRUCTION: Roads & Streets • Dams, Seaways & Piers • Detours • Buildings • Reconstruction of Disaster Areas

INDUSTRIAL AND UTILITY: Parking Areas • Freight Yards • Weigh Stations • Docks & Piers • Staging Areas • Production Work Areas

TRAFFIC: Tunnels • Viaducts • Bridges • Underpasses • Walks • Public Squares, Thruway Interchanges & Rest Areas • Cloverleafs • Parking Areas

UNDERWATER: Swimming Pools (Indoor & Outdoor) • Marine Life Displays • Municipal Garden Pools • Aquariums • Divers' Portable Units

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A quick scanning of the widely varied applications included in the Check-List at left proves again that floodlights often provide *better light from few source points at less cost* than conventional lighting.

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Send us a brief description of your lighting problem, or an indication of the floodlight types in which you are interested. We will send literature containing product information applying to your problem by return mail.

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Washington Report

Outlays for new construction in May were $4 billion, up 11% and a new high for the month. The January-May five month total was a record $17.1 billion, 3% ahead of the same period in 1956.

Public work spending was 12% ahead of the year earlier period, and a dominant factor in keeping 1957 dollar volume ahead of 1956 levels, Commerce & Labor Depts. reported. Total private outlays about equaled the 1956 record, both in May and for the five month period. New private housing activity declined 12% through May this year, and new store construction dropped 16%. These declines were offset by important gains in construction of utilities, industrial plants, office buildings, and churches and hospitals.

Capital investment in plants and equipment will be stepped up during the 3rd quarter, according to recent survey of Commerce Dept. and Securities & Exchange Commission, to a seasonally adjusted annual rate of $37.9 billion for the 3-month period. An increase of 6½% over 1956 is predicted for this year as a whole.

New housing starts in May were 102,000 units, a high for any month this year, but 10% under May of 1956, BLS reported. This was the lowest rate for May since 1951. Federal housing officials now estimate new starts for the year at between 900,000 and 1,000,000 units.

Outlook for tax relief next year grows dimmer as preliminary estimates for the 1959 budget indicate a $76 billion total, $4.2 billion higher than the controversial 1958 budget which has stirred a deluge of voter complaints over the past several weeks.

Economy moves are reportedly under study by the Administration, now disturbed by public reaction to continued high Federal spending. The Pentagon plans a $38 billion annual expenditure ceiling; Federal public works programs will be stretched out to slow down annual spending; Federal agencies and departments will be asked to hold budgets to a minimum.

Domestic copper producers are curtailing production in an effort to help reduce the over-supply, while price declines in world markets put pressure on American producers to cut prices. The U. S. price has held at 32 cents a pound since February 1957, while the mid-June London price was 28.5 cents a pound. World production continues to far outpace demand, while domestic inventories are the largest in many years.

Steel output rose slightly during June, and gave producers an optimistic outlook for the fall season as auto producers go into production on their 1958 models.

Economic highlights—Gross national product (GNP) this year will hit $435 billion, a House-Senate Economic Committee staff has concluded. Other conclusions were that consumer, business and Government purchase will continue to rise, housing activity appears near the end of its decline, inventory liquidation will cease and inventory accumulation will begin, and prices of finished products will continue to rise . . . Industrial production in May dipped to 146% (of the 1947-49 average), the third straight month to show a decline . . . Electric power output in mid-June was at 11.55 billion kwhr weekly, or 5.5% greater than similar week one year earlier . . . Personal income edged up to a record $340.4 billion annual rate in May, compared with $322.8 billion annual rate in May 1956 . . . Employment in mid-May was a total of 65,200,000 workers, while unemployment remained unchanged at 2,700,000 . . .Total consumer credit at end of April was $41 billion, up $2.8 billion from a year earlier . . . Cost-of-living index for April was 119.3, the eighth straight month to reflect an advance, BLS reported, and forecast that the rise would continue through July.

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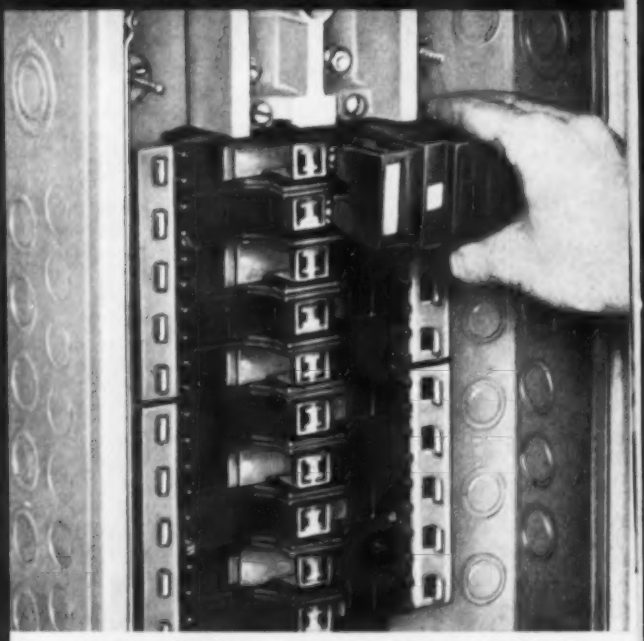
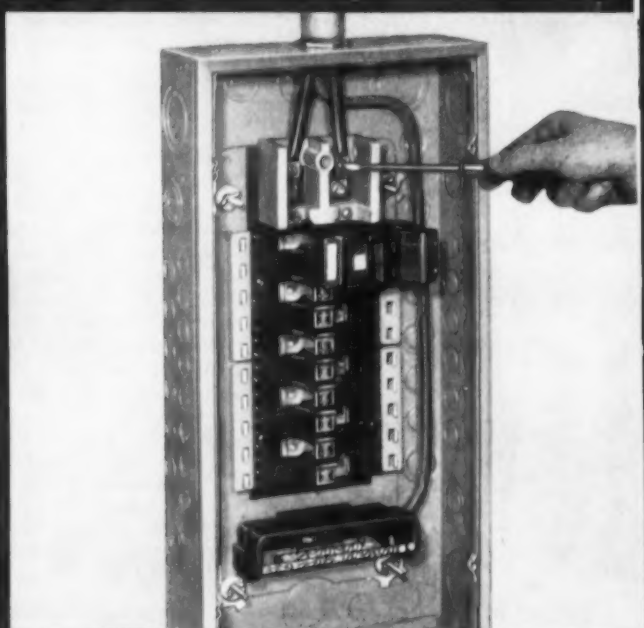
Transform Any Stab-lok Load Center Into A "Main Disconnect" Panel!

DUAL-RATED STAB-LOK ENCLOSURES
–all standard enclosures are approved for use as Service Entrance Equipment or as Load Centers. Readily available from distributor stocks.



DUAL-RATED 2P100 STAB-LOK–plugs into any 2-pole position in any Stab-lok enclosure ever produced...serves as either "main" or "branch circuit" protection.

AS SERVICE ENTRANCE EQUIPMENT
– connect line wires to lugs on 2P100 and 2P100 serves as "main disconnect" for entire panel.

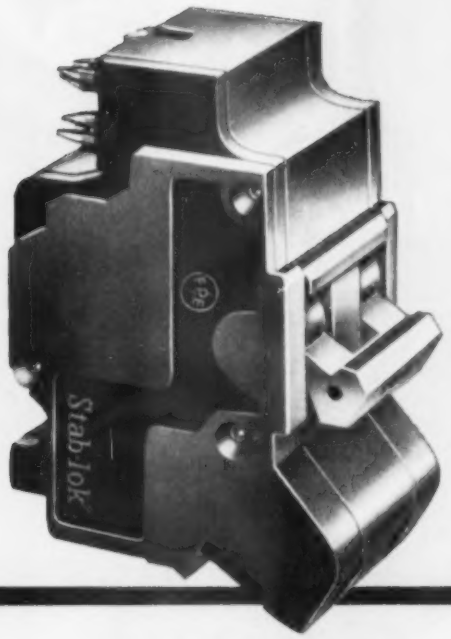


AS STANDARD LOAD CENTER–here, the line wires are connected to bus bar lugs. Now the 2P100 serves as a 100 ampere branch circuit breaker.

THE WORK OF TWO...

with the new

STAB-LOK 2P100



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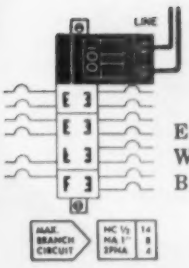
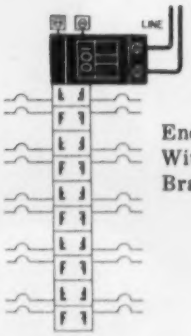
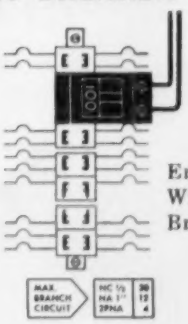
THE 2P100 USED AS "MAIN" CIRCUIT BREAKER



Enclosure 1620E
With 14
Branch Circuits



Enclosure 124
With 20
Branch Circuits



Enclosure 116-1
With 20
Branch Circuits

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COMPANY

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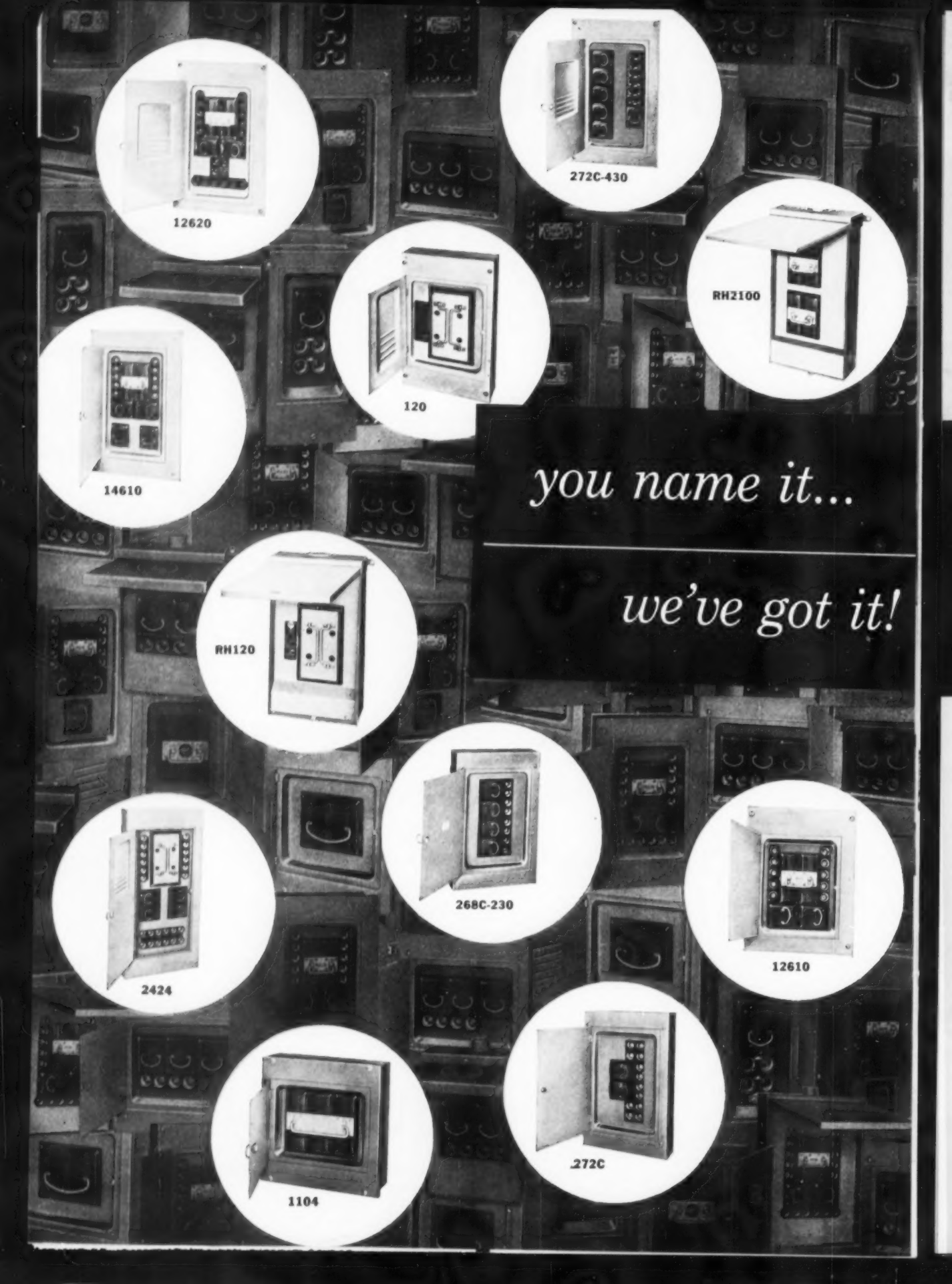
12620
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120
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you name it...
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RH120
268C-230
12610
2424
1104
272C

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200 AMPERE DEVICES

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RH2100 —200 amp., 120/240 volt A-C, 3-wire SN main lugs with two 100 amp., single phase pullouts in parallel. Adapted for Qwik-Align Interchangeable Hubs.

**Available in either flush or surface.*

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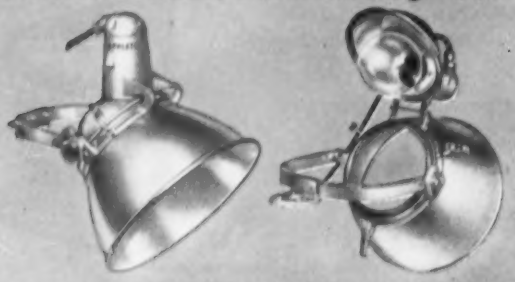
Plants at Newark, N. J.; Long Island City, N. Y.; Cleveland, Ohio; St. Louis, Mo.; Dallas County, Texas; Scranton, Pa.; Los Angeles, Calif.; San Francisco, Calif.; Santa Clara, Calif.; Emeryville, Calif.; Affiliated Plant, Toronto, Canada.

with APPLETON industrial lighting

Higher Production •

"INTENSO" alzak* aluminum floodlights

FOR STORAGE YARDS, ATHLETIC FIELDS, and other large areas.



The Intenso Alzak* Aluminum floodlight provides high-intensity, trouble-free illumination year-round. Each light complete with 4-ft. cord. Available in 18" and 20" etched or polished reflectors, 20° to 90° beam spread. For 750-1000 or 1500 Watt PS-52 lamps and 400 watt Mercury Vapor lamps.

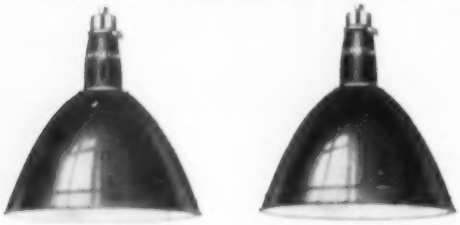
Split Second Rear Relamping—No tools needed . . . No nuts or bolts! Rear lid with lamp opens wide for quick, easy access.

Rifle Like Aiming—after servicing, just flip lid down and clamp! Due to impregnated asbestos gasket seal, Unit is now weather-proof. Exclusive louver ventilation eliminates condensation. Aim by looking through peep-sight, then lock in position . . . horizontal and vertical locking degree calibrations in each unit.

balanced MERCURY VAPOR and INCANDESCENT lighting

FOR ALL TYPES OF HIGH-BAY INSTALLATIONS.

PORCELAIN ENAMELED REFLECTORS

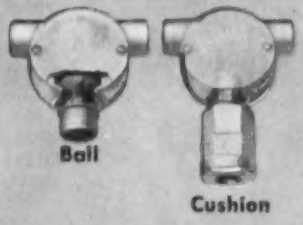


Ventilated Neck — Non-Ventilated Neck

PROCESSED ALUMINUM REFLECTORS

Ventilated Neck — Non-Ventilated Neck

TWIN HIGHLIGHT MOUNTING



"AL" SERIES FLEXIBLE FIXTURE HANGER UNILETS

Pendant suspension from a universal joint enables 20° swivel in any direction and assures a plumb position. The cushion type provides spring suspension . . . absorbs shocks and vibrations.

This quality line of balanced Mercury and Incandescent Lighting Fixtures offers the time-saving APPLETON DISKONECT feature where both lamp and reflector are removed as a complete unit for easy cleaning without disturbing wires!

The correct light for every industrial application — including hazardous locations — backed by the technical excellence and experience of APPLETON'S vast production facilities assures you of precision lighting products specifically designed to meet your needs. Write for complete information today . . . APPLETON — Standard for Better Lighting.

* A proprietary term of Aluminum Company of America

Sold through *franchised* wholesalers only

APPLETON ELECTRIC PRODUCTS

. . . you can see the difference!

Fewer Rejects • Improved Employee Relations • Extended Safety Records

"EFU" explosion-proof fluorescent fixtures

FOR HAZARDOUS LOCATIONS IN GRAIN MILLS, REFINERIES, CHEMICAL PLANTS, COLOR PRINTING PLANTS, PHARMACEUTICAL CONCERNS, ETC.

2, 3, and 4-Lamp fixtures . . . Straight or angle mounting

Choice of "Pre-Heat," "Slimline," or "Rapid Start" ballasts. Designed for use with 40-Watt, 48", T-12, and 85, 90, or 100-Watt, 60", T-17 fluorescent lamps. End housings are cast aluminum with line connections made to a terminal block in the junction chamber.

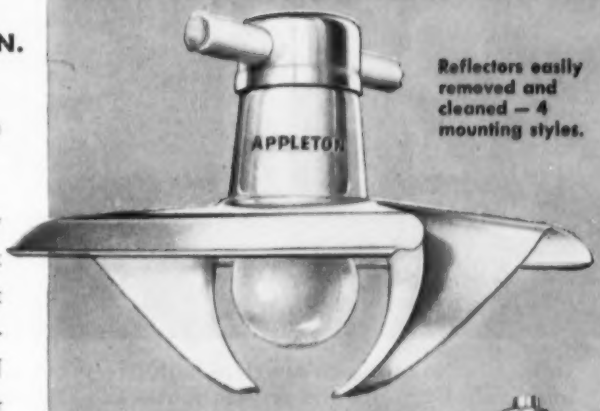
Relamp from either end of the fixture . . . long lamp life, long ballast life without starters . . . quiet, flickerless operation . . . APPLETON factory seal eliminating external seals normally required within 18" of arcing devices . . . These are quality features which give APPLETON "EFU" Explosion-proof fixtures their continually growing acceptance in all types of hazardous industrial applications.

APPLETON STOCKLITE

DESIGNED SPECIFICALLY FOR CORRECT SHELF AND BIN ILLUMINATION.

The novel shape cascades light where you need it . . . uniformly . . . from top to bottom on both sides of the aisle!

Spotty, harsh, eye-tiring lighting is a costly detriment to maximum efficiency in any stock area. Impossible to read numbers and product designations mean lost dollars in incorrect replacement part orders of all kinds. APPLETON Stocklites are attractive, distinctive, permanent fixtures finished entirely in white, vitreous-fired porcelain enamel. They are easily installed and extremely corrosion resistant . . . quickly pay for themselves by eliminating stock errors due to poor illumination.



Reflectors easily removed and cleaned — 4 mounting styles.

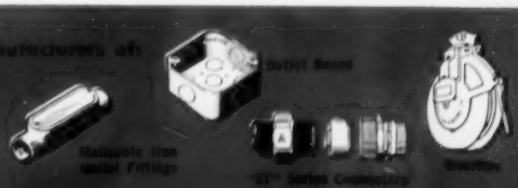
Separable design — no tools needed. Pendant, right-angle, feed-through, and outlet box mountings are available with separable keyless or pull-chain sockets. These are ¼ turn release and spring cushioned for firm contact. Take 5 standard lamps — 50 to 200 Watts.

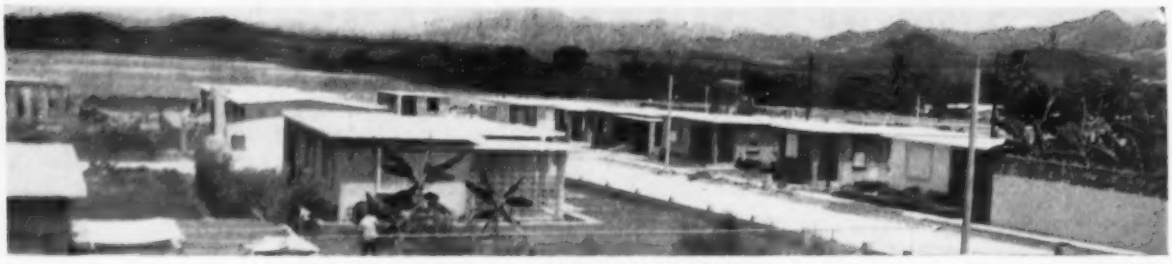
FLOODLIGHTS • REFLECTORS • DIFFUSERS • GROUP LIGHTS • HIGH MOUNTING FIXTURES • STAKLIGHTS • WALK LIGHTS • YARD LIGHTS • SERVICE STATION LIGHTS

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue • Chicago 13, Illinois

Also manufacturers of:

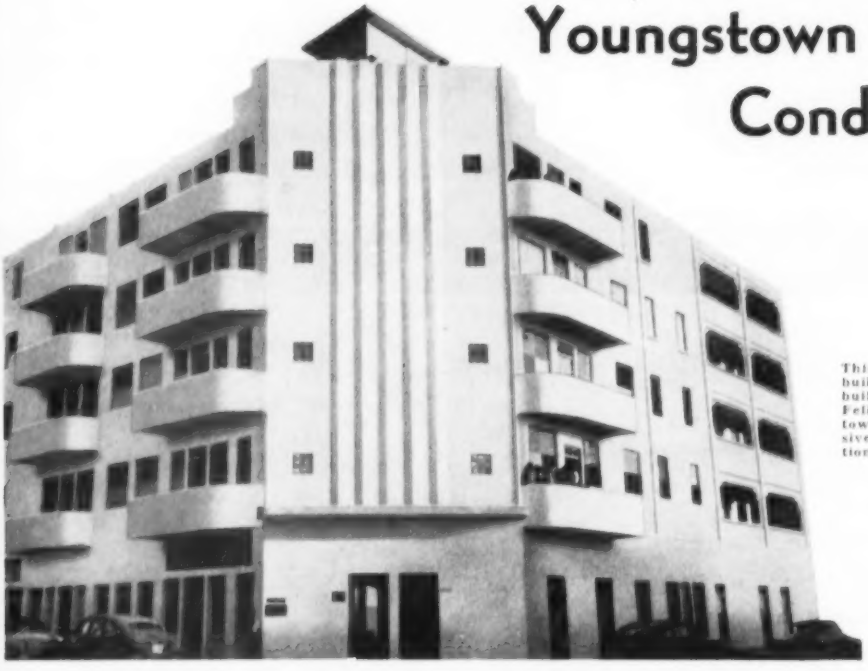




This 34-unit private housing project—known as "La Esperanza"—under construction by contractor Felix A. Torres utilizes "Buckeye" conduit exclusively.

MODERN PUERTO RICAN HOUSING PROJECTS GET LIFE-TIME PROTECTION FOR ELECTRICAL SYSTEM BY USE OF

Youngstown "Buckeye" Conduit



This modernistic 36-apartment building in Ponce, Puerto Rico—built and owned by contractor Felix A. Torres—utilized Youngstown "Buckeye" Conduit exclusively for wiring system protection.

In many of Puerto Rico's modern multi-story apartment buildings and private housing developments, Youngstown "Buckeye" Full Weight Rigid Steel Conduit has been used exclusively to give positive, safe, life-time protection for the electrical wiring systems. Electrical systems must function properly or they are definitely a bad investment. So to guarantee safe and efficient operation, leading owners, architects and contractors wisely specify Youngstown's "Buckeye" Conduit.

User's field reports tell us: " 'Buckeye' Conduit is easier to bend and thread—easier to fish wires through—and best of all, its superior corrosion resistance provides a much longer trouble-free service life."

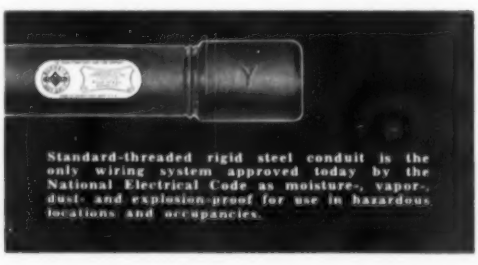
Leading industrial and electrical distributors carry complete and ample stocks—to serve you with on-the-spot delivery. They're awaiting your phone call—today.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

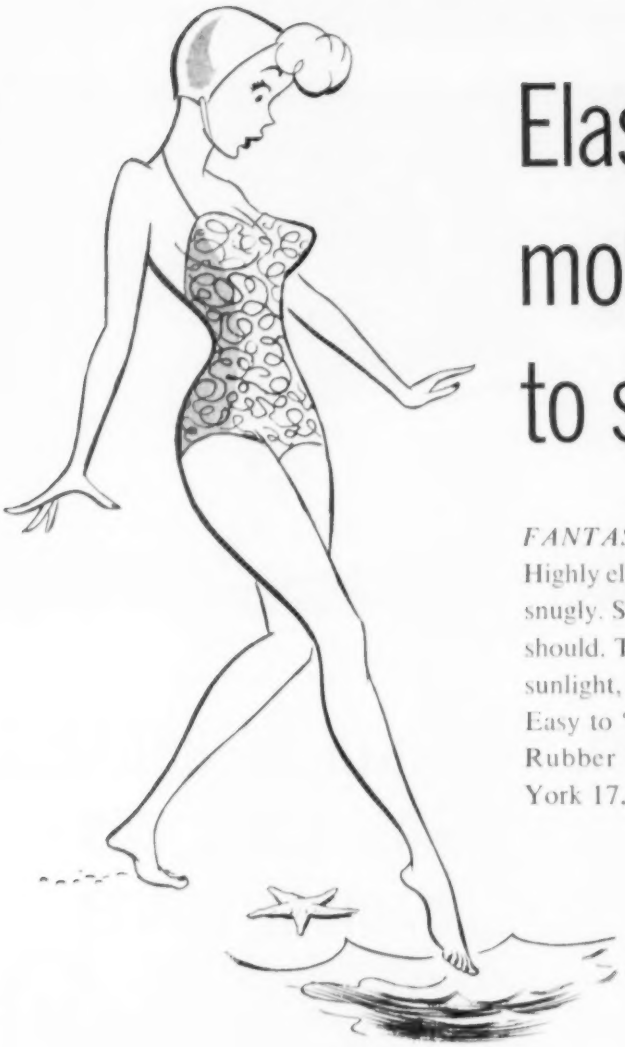
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

District Sales Offices in Principal Cities



Standard-threaded rigid steel conduit is the only wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.



Elastic— molds to shape

FANTASTIC? No, Gold Seal *Plastic* Tape. Highly elastic, it "flows" on to cover any surface snugly. STICKS and STAYS like a quality tape should. Tough plastic defies water, oil, solvents, sunlight, and weather. In handy 20 foot rolls. Easy to "swing" in tight places. Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

Gold Seal Tape

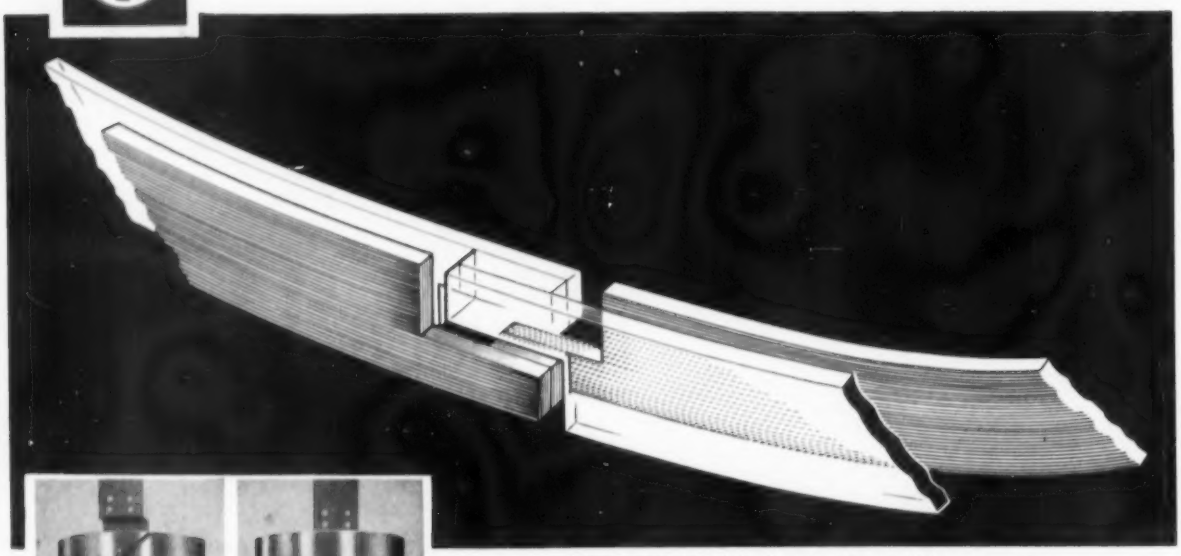
IN HANDY 20 FOOT ROLLS

Ten 20 ft. rolls in the Handy Pack can.

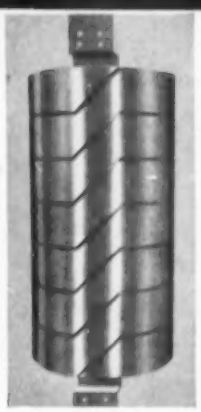
Single 60 ft. rolls in individual metal cans.

Gold Seal FRICTION — RUBBER — PLASTIC TAPES . . . Commercial and Specification Grades

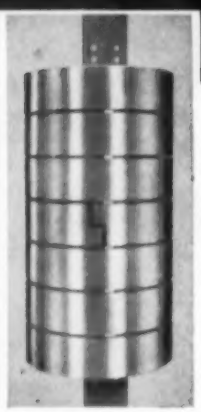
UNIT SUBSTATION TRANSFORMERS



Crossover point. Showing how inner winding connects with outer winding at center of transformer secondary.



Diagonal connections between rings.



Crossover point on reverse side of transformer.

BRUTE STRENGTH SECONDARIES WOUND FROM SOLID BUS— NO MECHANICAL JOINTS

Completed dry-type transformer mounted in ventilated housing.

From one end of the secondary to the other in these I-T-E unit substation transformers, electricity flows through solid copper bus bar.

This is a unique design for high current secondary windings embodying great structural strength, plus low reactance and high conductivity. Lengths of copper bus, cut on a diagonal and formed into rings, are brazed together below the diagonal gap in such a manner as to form a continuous electrical winding.

Where greater current carrying capacity is required, two such windings are paralleled, but a crossover at the midpoint causes each of the parallel paths to have half its turns in the outer layer and half in the inner—equalizing the impedance of the two parallel paths and distributing the reactance evenly.

Write for complete information. I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

Transformer & Rectifier Division

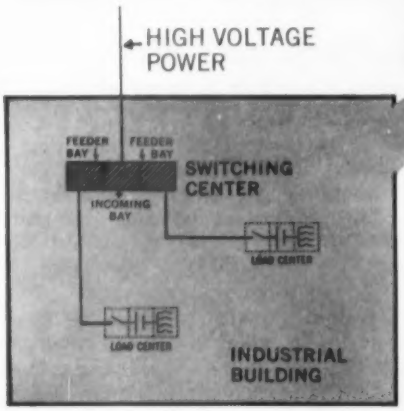
FOR INDUSTRIAL HIGH-VOLTAGE POWER CIRCUITS—

buy the right protection in your switchgear—buy S&C Metalclad Switchgear—Save 50%

Industrial circuits do not have transient faults. They cannot be re-energized immediately after an outage.

Hence costly circuit breakers are unnecessary. S&C Power Fuses give the right protection.

The new switching center for the E. R. Squibb and Sons Antibiotic Laboratory and Manufacturing Plant at New Brunswick, N. J.—a division of Olin-Mathieson



A typical industrial high-voltage distribution system. The darkened area represents the functional position of such a switching center as shown above in the Squibb installation.

For industrial high-voltage power circuits, conductors run in cables or conduits. They are not exposed to lightning, falling trees, rodents, wind, or ice which typically cause transient faults.

Consequently, the only faults that occur are permanent faults and S&C Power Fuses give the right protection against them.

The quick reclosing feature of expensive circuit breakers is of no value here.

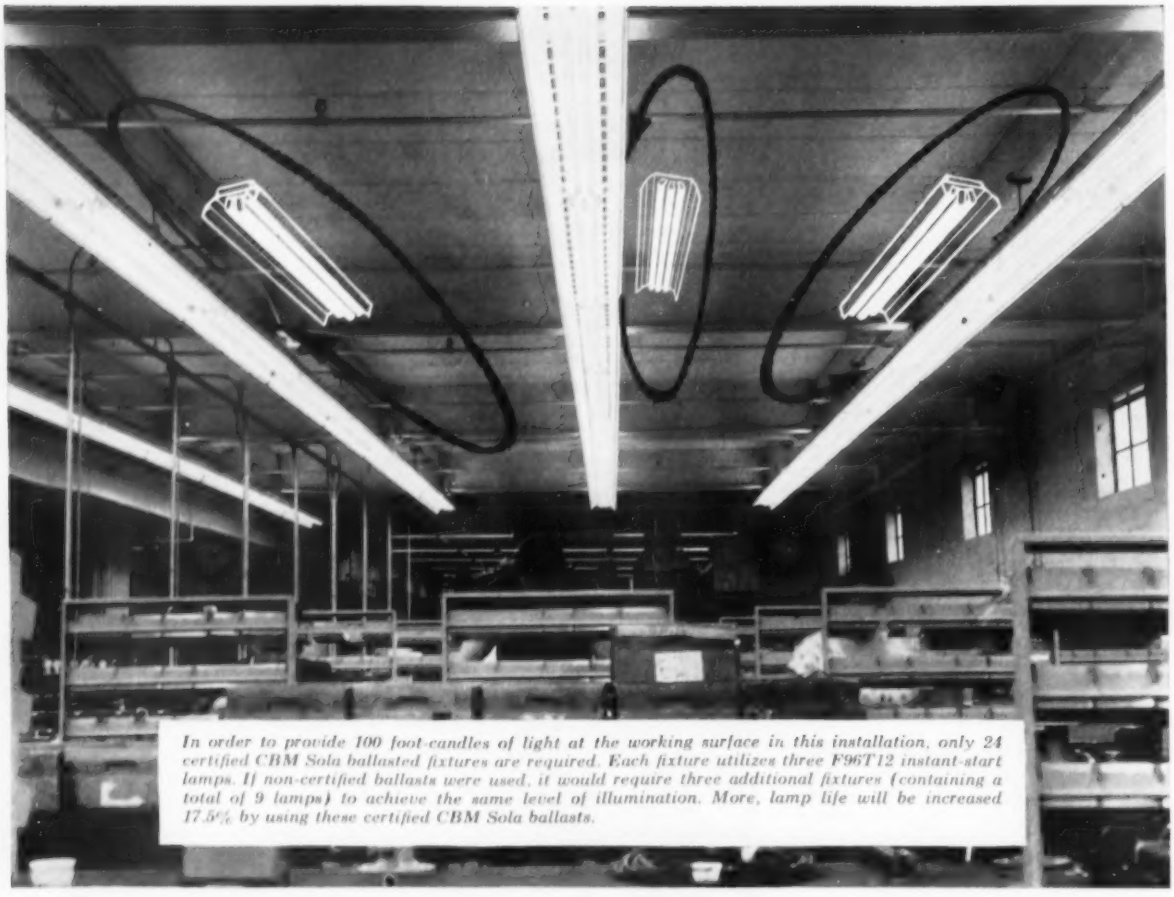
S&C Metalclad Switchgear—by using S&C Power Fuses rather than circuit breakers, and by incorporating load interrupters for full load switching—brings substantial savings in switchgear costs—sometimes as much as 50%.

Specialists in High-Voltage Circuit Interruption for Utilities Since 1910

S&C ELECTRIC COMPANY

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

4433 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.



In order to provide 100 foot-candles of light at the working surface in this installation, only 24 certified CBM Sola ballasted fixtures are required. Each fixture utilizes three F96T12 instant-start lamps. If non-certified ballasts were used, it would require three additional fixtures (containing a total of 9 lamps) to achieve the same level of illumination. More, lamp life will be increased 17.5% by using these certified CBM Sola ballasts.

How you can make 24 fixtures do the work of 27 . . . and extend lamp life 17.5%

To do its job efficiently and economically, a fluorescent lighting ballast *must* meet certain requirements for lamp life, light output, cool operation, reliable striking, and long ballast life. Minimum accepted standards for all of these factors have been set up by lamp manufacturers and *Certified Ballast Manufacturers*. Ballasts that meet or exceed these standards are called certified CBM ballasts, and carry a diamond shaped CBM emblem.

All Sola ballasts for general lighting applications are made to CBM specifications in every case where they exist, and are so certified. In addition, every Sola ballast carries the UL (Underwriters' Laboratories) emblem.

Many maufacturers are now making ballasts which carry *only* the UL emblem. *These ballasts are not designed to meet CBM specifications for minimum standards of performance.* Underwriters' Laboratories performs a valuable, but highly specialized function in testing ballasts. The UL emblem indicates *only* that safety requirements are met — UL does *not* test for operating characteristics that assure efficient, economical lamp performance and long lamp life.

Tests of these non-certified ballasts show that they reduce lamp life up to 28%; light output up to 13%, compared with certified CBM Sola ballasts used in the same installations. We invite you to send for an engineering report which shows what this means in operating costs. This report proves that although non-certified ballasts may sell for a *few cents less*, the operating costs of lighting systems incorporating them is *many dollars more* in terms of reduced lumen output and lamp life.

Write today for your copy of this report on the real cost of non-certified fluorescent lighting ballasts.

SOLA ELECTRIC CO., 4633 W. 16th St., Chicago 50, Ill.

SOLA *Fluorescent* **BALLASTS**

CONSTANT VOLTAGE TRANSFORMERS • LIGHTING TRANSFORMERS • CONSTANT VOLTAGE DC POWER SUPPLIES
SOLA ELECTRIC CO., 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • NEW YORK 35: 103 E. 125th St., TRafalgar 6-6464
PHILADELPHIA: Commercial Trust Bldg., Rittenhouse 6-4988 • BOSTON: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354 • CLEVELAND 16: 19115 Detroit Rd., EDison 3-2223 • KANSAS CITY 2, MO.: 406 W. 34th St., Jefferson 4382 • LOS ANGELES 23: 3138 E. Olympic Blvd., ANgelus 9-9431 • SOLA ELECTRIC (CANADA) LTD., TORONTO 17, ONTARIO: 102 Laird Drive, Mayfair 4554 • Representatives in Other Principal Cities

GENERAL CABLE

BUILDING WIRE

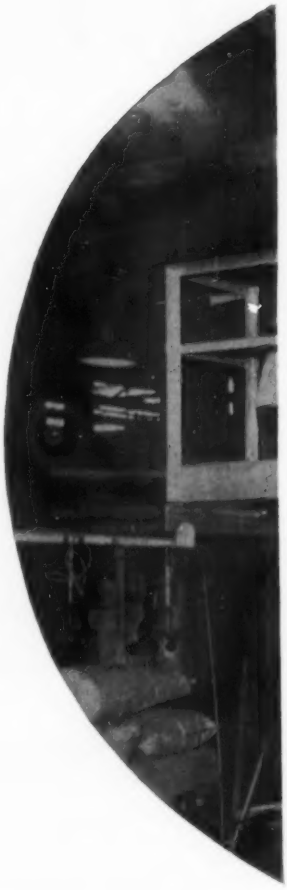
immediate delivery through over 500 Authorized Distributors!

Make your job easier, save time and money: rely on General Cable's Authorized Distributors for prompt, on-time delivery of your wire and cable needs. Over 500 Authorized Distributors are backed up by large stocks in General Cable's Distributing Centers strategically located from coast-to-coast. For the best in quality and service, buy from an Authorized General Cable Distributor.

GENERAL CABLE CORPORATION,
420 Lexington Avenue, New York 17, N.Y.
Offices and Distribution Centers Coast-to-Coast

for quality and service... **specify GENERAL CABLE**

"Our Turbo Air Blowers were often shutdown by motor starting currents . . . *until we changed to Fusetron Fuses*"



"As our Turbo air blowers build up speed there is a back up pressure exerted which puts an overload on the motors. Consequently, it takes longer for the motors to gain normal running speed.

"Frequently, the 100 ampere renewable fuses we were using couldn't hold these overloads—and we would have a shutdown.

"We were anxious to eliminate these down-periods, but we didn't want to sacrifice safe fuse protection on our 30 h. p., 3600 R. P. M., 220 volt, 3 phase, 60 cycle motors that power the Turbo air blowers.

"We decided to protect these motors with 100 ampere Fusetron dual-element fuses. This move proved to be the answer to our problem. Since changing to Fusetron fuses we haven't had any trouble with our Turbo air blowers being 'knocked out' on motor starting currents."

B. D. McGaughey
ELECTRICAL SUPERINTENDENT,
Copperweld Steel Company, Glassport, Pa.

HERE'S HOW FUSETRON FUSES PROTECT AGAINST NEEDLESS BLOWS CAUSED BY HARMLESS OVERLOADS.

Fusetron dual-element fuses will hold motor-starting currents or other harmless overloads without opening because they have a tremendous time-lag.

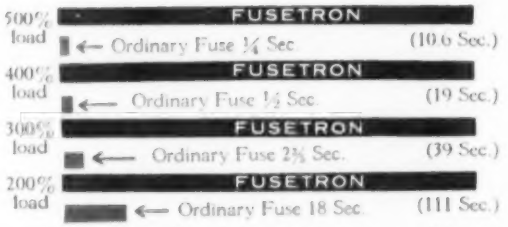
A machine may momentarily stall or be overloaded and Fusetron fuses won't open.

A motor may be started under heavy load—or all the motors on a circuit may be started at once—and Fusetron fuses won't open.

Circuits can be loaded nearer to the capacity of panelboards and switches without having Fusetron fuses open needlessly.

Here's a comparison of time-lag between Fusetron and ordinary fuses

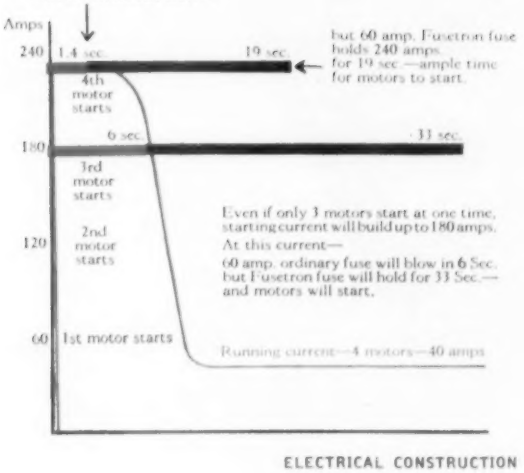
Notice that even at 500% load a Fusetron fuse will hold on for more than 10 seconds—while an ordinary fuse will open in less than ¼ second. Yet, with all this time-lag, there is no sacrifice of safety.



Comparison is based on ordinary fuses with the longest time-lag. Figures apply to 30 amp. 250 volt size. Opening time on larger sizes and on 600 volt sizes is longer.

Here's an example of how Fusetron fuse time-lag works

For example: take four 10 amp. motors on a circuit. 60 amp. ordinary fuses would be used to protect the circuit. BUT see what happens when four motors start at one time. The starting current of each motor is about 60 amps. so the combined starting currents would reach 240 amps.


At this load—
60 amp. ordinary fuse blows in 1-4/10 Sec. before motors can start—
Amps
240
1.4 sec.
19 sec.
but 60 amp. Fusetron fuse holds 240 amps. for 19 sec.—ample time for motors to start.
4th motor starts
6 sec.
33 sec.
180
3rd motor starts
Even if only 3 motors start at one time, starting current will build up to 180 amps.
At this current—
120
2nd motor starts
60 amp. ordinary fuse will blow in 6 Sec. but Fusetron fuse will hold for 33 Sec.—and motors will start.
60
1st motor starts
Running current—4 motors—40 amps

So with Fusetron fuses installed in Mains, Feeders and all Branch circuits—shutdowns caused by needless blowing of fuses are ENTIRELY WIPED OUT.

Don't risk losses! One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with Fusetron dual-element fuses. Write for bulletin FIS.

For loads above 600 amps.— Use BUSS Hi-Cap Fuses to coordinate your electrical circuits.

On 600 volts or less, BUSS Hi-Cap fuses have an interrupting capacity sufficient to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuits of origin. Write for bulletin HCS.

Bussmann Mfg. Division (McGraw-Edison Co.)
University at Jefferson, St. Louis 7, Mo.

Play safe! *install Fusetron dual-element fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!*

BENJAMIN

always the source of Good Lighting . . . anywhere in the plant!

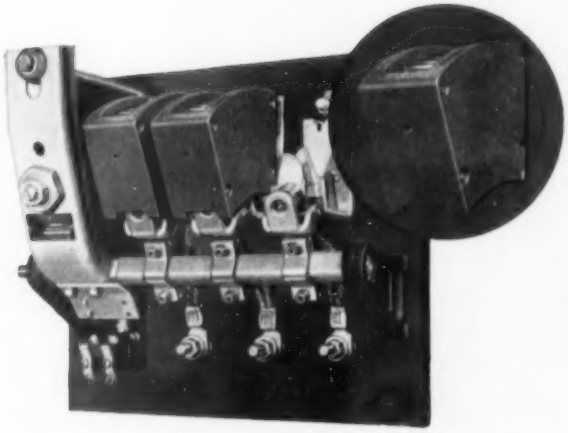
. . . and your installation worries are on our mind!

Whether it's a continuous line fluorescent system or just a couple of dome reflectors, the contractor's installation worries come first with Benjamin. That's why each Benjamin Unit has special "contractor-designed" features to make it easier to put up. Such things as complete pre-wiring, easy to get-at control equipment, simplified suspensions, and plenty of knock-outs in the right places, take all installation problems off your mind!

Benjamin Electric Mfg. Co.,
Des Plaines, Ill.

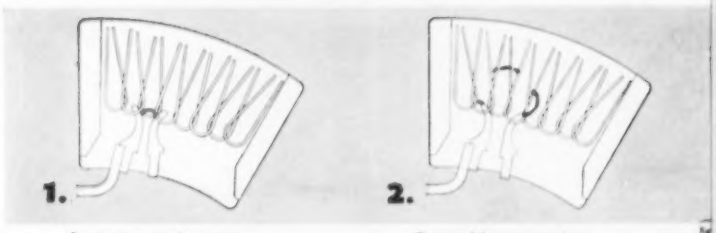
1. Explosion-Proof Units
2. Vapor-Tight Incandescent
3. Triple-Flo Continuous Lines
4. Stream-Flo Continuous Systems
5. Stream-Flo w/27° Shielding
6. RLM Dome Reflectors
7. Stream-Flo w/Plastic Covers
8. Elliptical Angle Reflectors
9. Steelite Armor-Clad Units
10. Twin-Flo Individual Units
11. Symmetrical Angle Units
12. Semi-Direct Industrial w/25% Uplight
13. Twin-Flo w/10% Uplight
14. Panel-Glo Safari Systems
15. Stock-Bin-Lite
16. Officer Louvered Units
17. Panel-Glo Corrugated Systems
18. Glass-Enclosed Troffers
19. RD Projectors
20. Duo-Service Floodlights

for fast arc interruption... without blowout coils



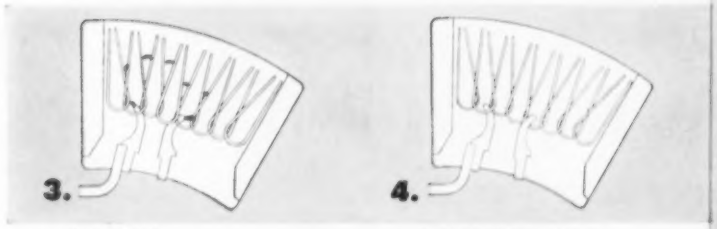
ALLIS-CHALMERS
TYPE 425 CONTROL
featuring ACBO arc-centering blowout chutes for 50 to 400 hp

The advanced electrical design of Allis-Chalmers Size 4, 5 and 6 control incorporates a modern principle of arc interruption for low voltage, high horsepower applications. The *ACBO* arc chute utilizes principles of magnetic action and thermal convection to center, rupture and extinguish the arc . . . quickly. Fast arc interruption assures maximum contactor efficiency, improves performance — greatly prolongs contact and chute life.



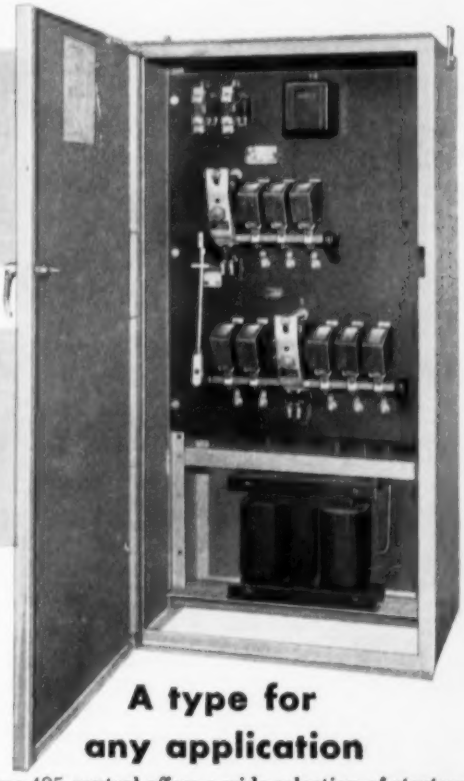
Arc across contacts as they start to open.

Strong blowout action forces arc to center.



Arc rupturing.

Contacts fully open— arc extinguished.



Simplified mechanical design

- Streamlined clapper-type construction eliminates many parts.
- Accessibility simplifies maintenance and inspection.
- Installation is fast and easy . . . sensible enclosure dimensions provide ample wiring space.

A type for any application

Type 425 control offers a wide selection of starters and contactors for any application. For detailed information, call your A-C Control Distributor or your local A-C District Office . . . or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. Ask for Bulletin 14B8615.

ACBO is an Allis-Chalmers trademark.

A-5343

ALLIS-CHALMERS

ALL NEW "JF" MANUAL AUTOSTARTER

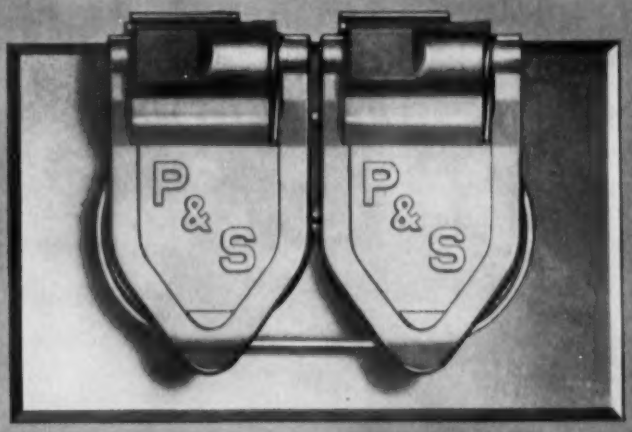
...air break contacts in all ratings!

Now Westinghouse offers a completely new manual auto-starter with air break contacts in all sizes . . . for starting motors from 5 to 250 hp. Gone forever are the costly "oil problems" of oil level checks, spilling, messy oil changes and contamination. Tests prove that air break operation gives additional benefits in much longer contact life. Westinghouse gives you all this plus premium-quality silver-alloy contact surfaces and the De-ion® arc quenching chamber for guaranteed long trouble-free service.

There is a host of additional moneysaving features incorporated in the new Westinghouse "JF" auto-starter to make it your best buy today. For all the facts call your Westinghouse sales representative or nearby Westinghouse distributor, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-22023

YOU CAN BE SURE...IF IT'S Westinghouse

NEW



P&S 4500 WEATHERPROOF SPRING DOOR COVER

Fits any duplex outlet...

WATERTIGHT, RUSTPROOF
EASY TO USE AND INSTALL
STURDY AND SMARTLY STYLED

The market for the NEW P&S 4500 Weatherproof Spring Door Cover is as big and inviting as all outdoors!

This versatile unit will protect *any* duplex outlet, including the new 125- and 250-Volt grounding devices. Covers open independently and spring shut automatically when the plug is removed.

Handsome and hardy, the P&S 4500 cover is made of non-corrosive aluminum with baked-on lacquer; springs of stainless steel; screws and spring covers of chrome-plated brass. Hinge pin and cover are cast in one piece for extra strength.

For all your needs in electrical wiring devices, specify nothing less than P&S, standard of quality and dependable performance for more than 65 years. Write for catalog information to Dept. ECM-28.

PARALLEL

T-SLOT

3-WIRE GROUNDING

POLARIZED

TURNLOK

TURNLOK

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N. Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada, Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

MAKE THE COMPLETE JOB COMPLETELY P&S

SPECIFY QUALITY . .

INSIST ON McGILL® PORTABLE LAMP GUARDS

McGill Industrial Lampguards give you an extra margin of quality—in materials and workmanship—that assure a safe dependable light; where you want it, when you need it. Parts and materials are all carefully selected for resistance to wear and abuse in rugged industrial service. 660 watt, 250 volt sockets. Choose the right lamp guards for your needs from the more than 100 different type offered by McGill.

Underwriters Laboratories Inspected

No. 7100 SR Lamp Guard

Clamp arrangement allows quick lamp changing without tools. Gray Neoprene-butyl handle, reflector, LEVOLIER® switch and extra heavy steel cage.

No. 5025 SRG Service Light

Completely grounded service light. 15 amp., 125 volt convenience outlet built into molded phenolic handle. Safe on-the-spot source for power tools, etc. 25 feet 16-3-SJ black rubber cord.

No. 5000 SR Lamp Guard

With 15 amp., 125 volt convenience outlet in impact and heat- and grease-reisting, positively insulating molded phenolic handle. No-Rol cage and reflector.

No. 3006
Vaporproof Lamp Guard

Watertight, vaporproof and moisture proof for complete safety. Heat and impact resisting glass globe screws into a silicone rubber gasket. Handle molded of macerated phenolic.

No. 652 Lamp Guard

Rubber hook handle, thumb release clamp for easy bulb replacement can be hung, for maximum light, from hook or handle.

No. 5000 SLRG Lamp Guard

Completely grounded. 15 amp,. 125 volt 3-wire convenience outlet for 2 parallel blades and a U shaped blade for ground. Molded phenolic handle. Resists oil, grease, breakage, moisture and abrasion. End lens concentrates light.

FREE

Send for free copy of McGill Catalog No. 84 . . . . today!

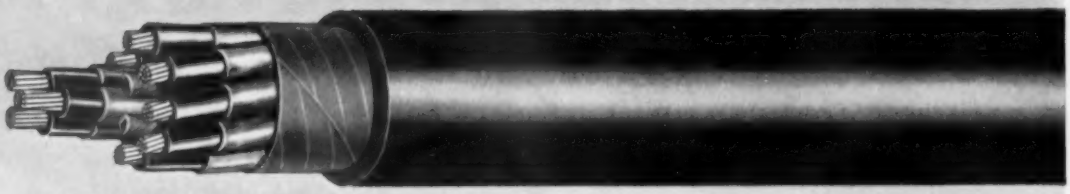
McGILL®
ELECTRICAL SPECIALTIES

are always a little better and ***ALL*** *are Underwriters Laboratories Inspected*

McGILL MANUFACTURING COMPANY, INC. **450 N. Campbell St., Valparaiso, Indiana**

walker of Conshohocken

CHOOSE THESE PRECISION-MADE WALKER STATION CONTROL CABLES



600 Volt Service

Types of Walker Control Cable

Insulation on Conductors	Overall Jacket	Description
Walkerzone with Neoprene Sheath (Walkerprene)	Neoprene (Walkerprene)	Temperature rating 85°C. Best grade insulation—Walkerzone, butyl rubber—ozone, heat and moisture resistant. Neoprene sheath on each conductor.
Walkerine (RH-RW) with Neoprene Sheath	Neoprene (Walkerprene)	Temperature rating 75°C. Walkerine (RH-RW) heat and moisture resistant insulation. Neoprene sheath on each conductor.
Polyethylene	Polyvinyl Chloride (Walkersyn)	Temperature rating 80°C. High dielectric strength and resistance to corona and ozone. High insulation resistance.
Polyvinyl Chloride (Walkersyn)	Polyvinyl Chloride (Walkersyn)	Temperature rating 60°C. Higher temperature rating can be furnished on special order.

Applications

Generating stations and substations
Industrial plants
Remote control operation of motors, circuit breakers, and power equipment
Motor leads
Relay and metering circuits
Leads from temperature recording devices on rotating equipment to the switchboard
Wherever multiple conductor cable is required and current requirements are met

Range Walker station control cables are furnished for 600 volt service and in sizes 14, 12, 10 and 9 in any number of conductors up to 37. In some sizes and types, cables can be furnished with a greater number of conductors.

On your next job, be specific — specify WALKER Wire and Cable

WALKER BROTHERS

Conshohocken, Pa.

walker of Conshohocken

UNDERFLOOR ELECTRICAL DISTRIBUTION SYSTEMS
RIGID STEEL CONDUIT • E.M.T. • WIRE AND CABLE

In this new AMERICAN METER COMPANY plant...

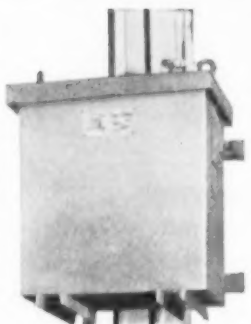
UPTEGRAFF TRANSFORMERS

provide: *dependable design, quality construction, efficient operation, overall economy*

The American Meter Company has ten plants throughout the United States where pressure-measuring meters for water and gas are manufactured. The above new plant is a typical example of how Uptegraff transformers efficiently and with maintenance-free long life serve important industries as well as utilities.

The transformers range from 1000-kva outdoor power transformers, seen on the next page, to the indoor dry-type transformers, below, both overhead and floor mounted. The main outside bank of Uptegraff transformers connects to Philadelphia Electric Company's 33-kv lines. This high voltage is permitted for the use of the industrial company. It reflects the high degree of confidence of the American Meter Company in the design and construction of Uptegraff transformers.

Uptegraff makes a complete line of Power, Load Center, Distribution—overhead and station type, Network, Instrument, and Specialty transformers. Write for Engineering Data *today*.



A typical Uptegraff indoor specialty transformer for overhead mounting. Made by the Terra Alta Division, this dry-type transformer is rated at 30 kva.

R. E. UPTEGRAFF MANUFACTURING CO.

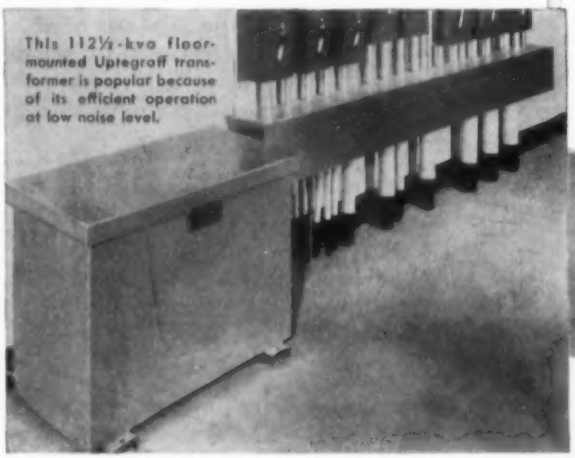
Scottdale, Pennsylvania

Architects and Engineers
George M. Ewing Co.
Philadelphia, Pa.

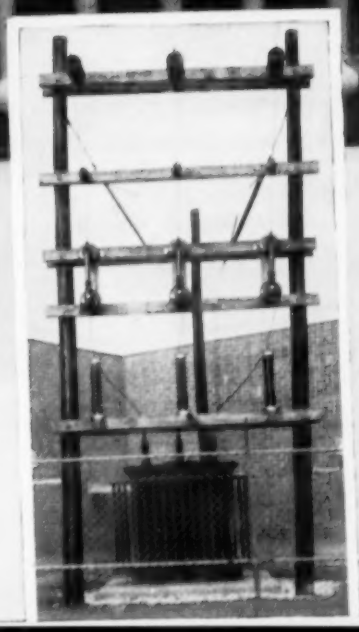
Consulting Engineer
Louis W. Moxey III
Philadelphia, Pa.

General Contractors
Nason and Cullen, Inc.
Philadelphia, Pa.

Electrical Contractor
Seaboard Electric Co.
Philadelphia, Pa.



This 112½-kva floor-mounted Uptegraff transformer is popular because of its efficient operation at low noise level.



It pays to standardize on **UPTEGRAFF**

. . . Using the Finest Electrical Tape

. . . Dutch Brand

DUTCH BRAND PLASTIC ELECTRICAL TAPES

Thin, strong, flexible with unusual resistance to destructive elements. Three thicknesses: .007", .010", .020".

DUTCH BRAND VINYL COLOR TAPE

Nine colors, four widths for all insulating, coding, indexing. U. L. listed.

DUTCH BRAND RUBBER TAPE

The finest tape of its kind. Resists up to 18,000 volts through a single thickness.

DUTCH BRAND FRICTION TAPE

An industry favorite for over 40 years. For perfect adhesion, for longest life choose Dutch Brand.

Get the Best . . .
ask for Dutch Brand

Throughout industry Dutch Brand Tapes have earned the top reputation. Why? Because they are made to do the best job. They start with the finest raw materials and process them at every step with the greatest care and skill. The result is a finished product that exceeds the specifications and standards of the industry. Ask your suppliers for Dutch Brand. You are paying for the best—so be sure you're getting it.

1-2072

JOHNS-MANVILLE DUTCH BRAND PRODUCTS OF QUALITY

Johns-Manville
DUTCH BRAND
PRODUCTS
7800 WOODLAWN AVENUE • CHICAGO 19, ILL.

GEDNEY'S RIGHT THERE IN YOUR CORNER

helping save time . . . hold down costs

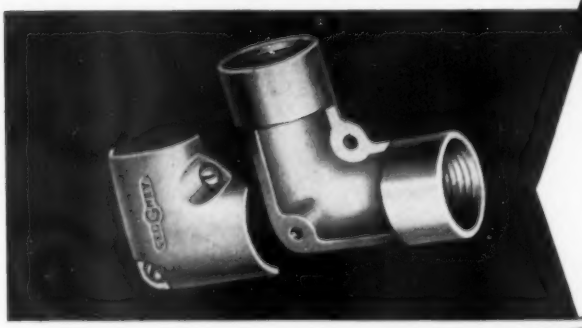
CORNER FITTINGS? Well, here are three that have proved immensely popular for the simple reason they're easiest to install – save time and labor that really counts up. Like the rest of the full Gedney line they're made of unbreakable malleable iron...accurately machined and threaded . . . individually inspected. Order Gedney – always – for lowest installed costs!

90° CORNER ELLS

Fitted with gasketed cover. Both ends female. Made of malleable iron, cadmium plated. Available in a full range of sizes from ½" to 2".

90° CORNER ADAPTERS

Fitted with gasketed cover. One end male, one end female. Made of malleable iron, cadmium plated. Your choice of sizes from ½" to 2".



CORNER PULL-IN CONDUIT ELLS

Today's top specification for space-saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated. Sizes run from ½" to 2".

GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

GEDNEY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

20,000 FL* REDUCED TO 50 FL PROVES

HONEYLITE® ELIMINATES GLARE!

Right after this photograph was taken an illuminating engineer from an independent laboratory took Footlambert readings. His findings are as follows: each of the battery of photographer's floodlights produced 20,000 FL; the six Honeylite panels gave overall 340 FL readings; the little girl's face showed 120 FL; and the page in her picture book was all the way down to 50 FL . . . a light soft enough for the youngest eyes!

See our Catalog in Sweet's file 11a/He

* Footlambert – the standard unit of surface brightness – as measured with a Spectra Brightness Spot Meter. Name of testing laboratory available on request.

HONEYLITE®

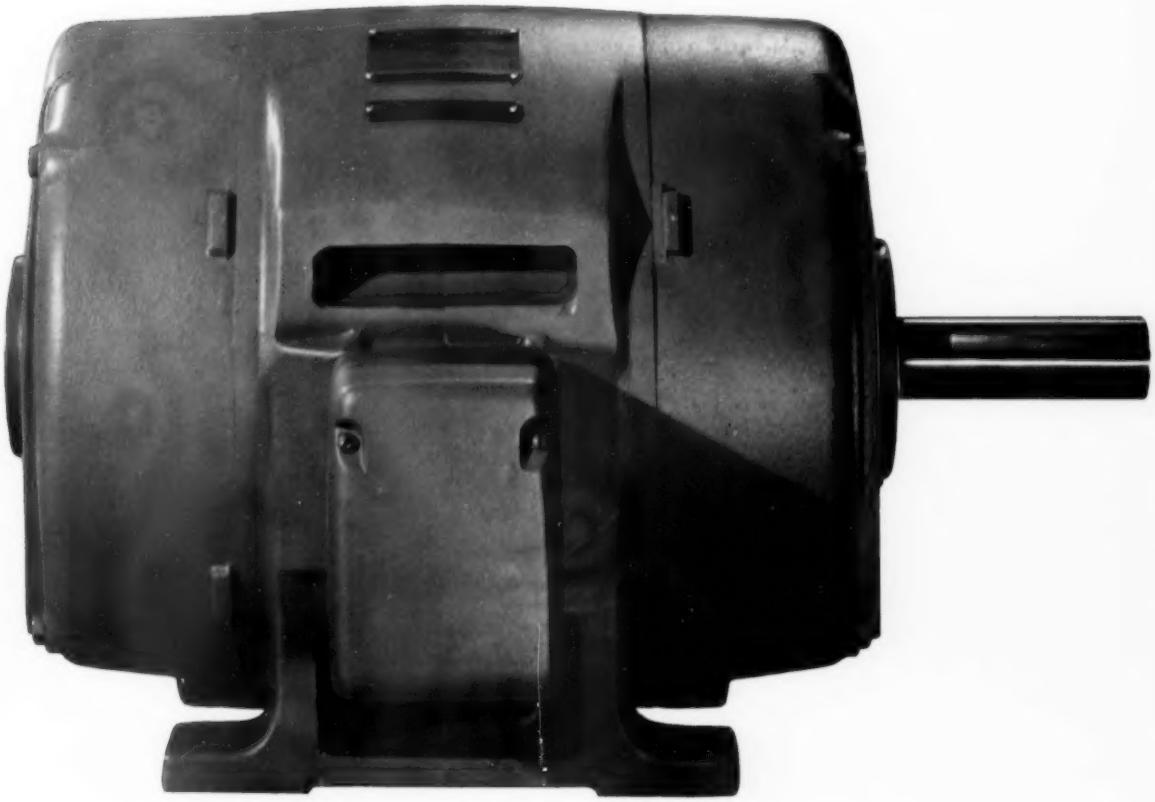
LIGHT-DIFFUSING ALUMINUM HONEYCOMB

A DEVELOPMENT OF **HEXCEL PRODUCTS INC.**

9851-61ST STREET, OAKLAND 8, CALIFORNIA

NEW

FROM GENERAL ELECTRIC



TRI 55 CLAD MOTORS

REG. U.S. PAT. OFF.

NOW UP TO 125 HP

GENERAL ELECTRIC

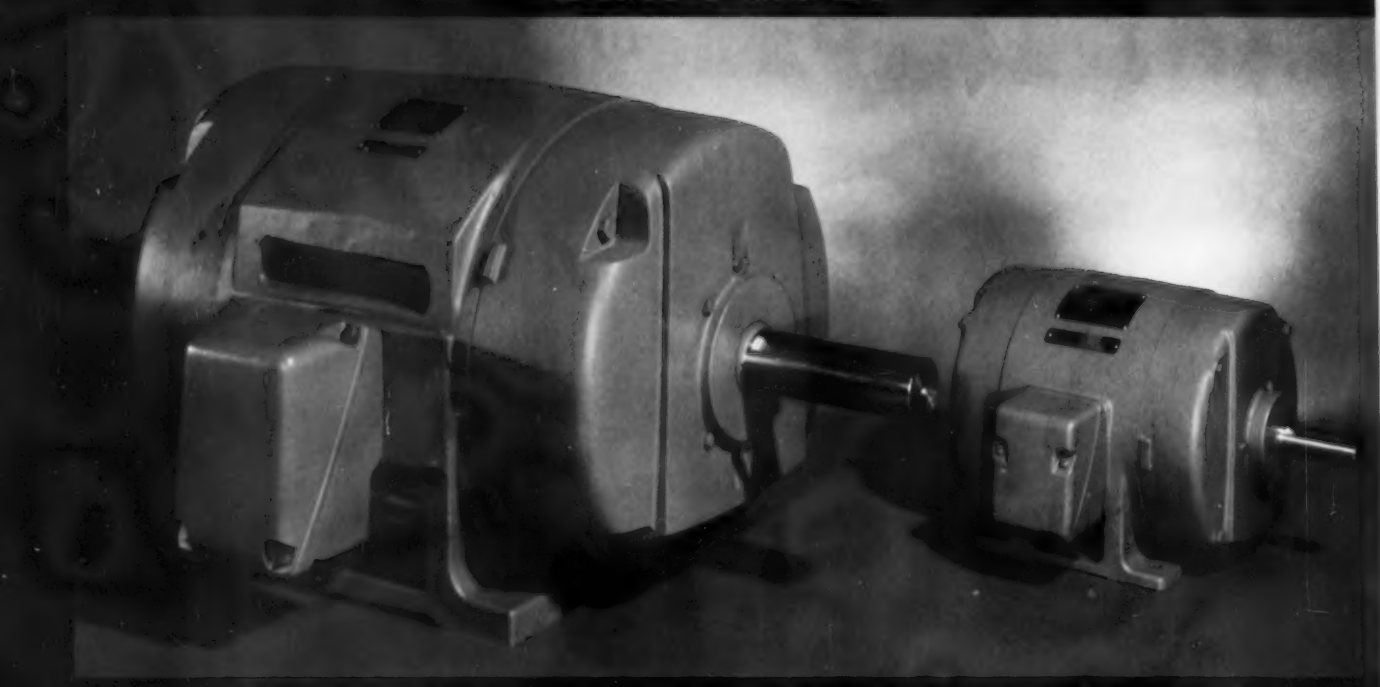
compact . . . power-packed

General Electric TRI 55 CLAD

REG. U.S. PAT. OFF.

NOW UP

DRIPPROOF

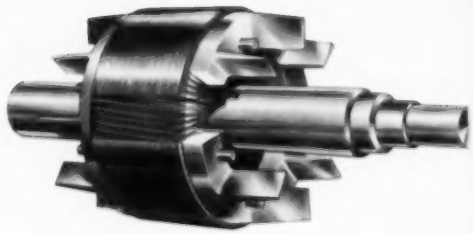


DESIGNED, BUILT AND TESTED FOR

FULLY PROTECTED by cast-iron enclosures, Tri-Clad '55' motors handle many jobs where ordinary drippproof motors cannot be applied.

MYLAR* slot insulation, Formex® wire, non-wicking Geoprene® leads and Dri-Film® silicone coating increase stator life up to 50%.

*Registered Trade-mark Dupont Co.



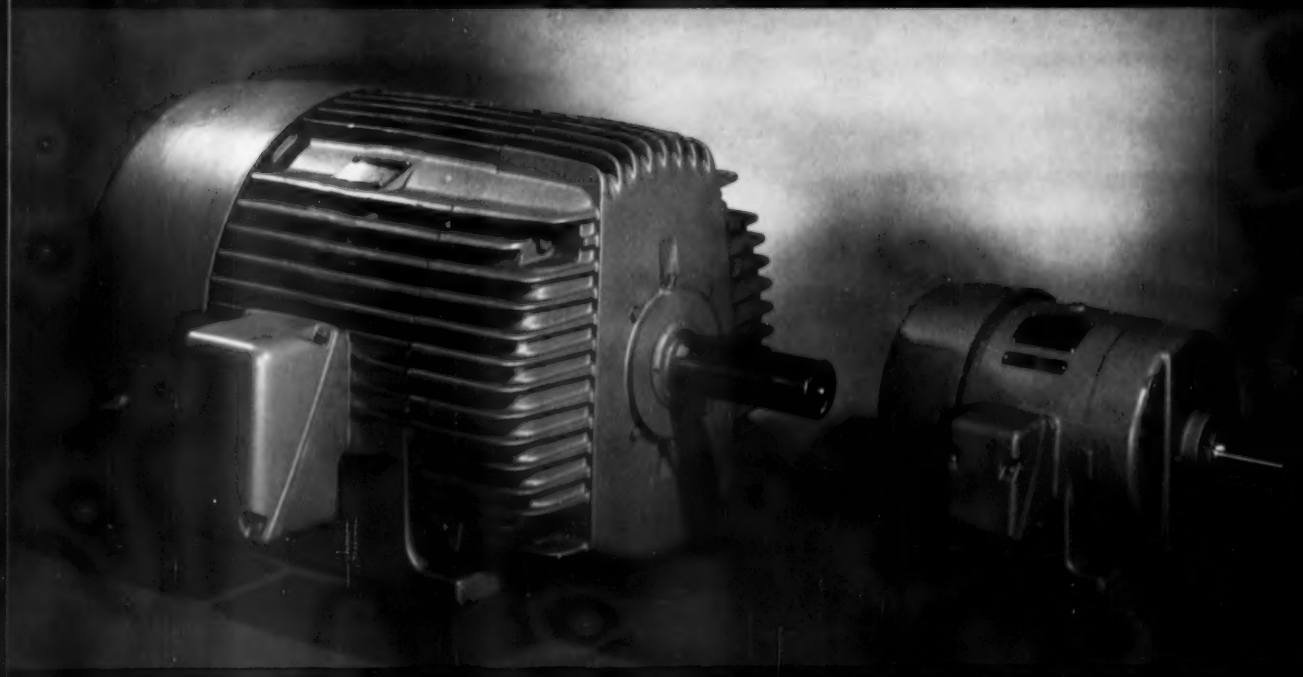
IMPROVED ROTORS are solid cast of pure aluminum for greater strength, higher conductivity. Rotor bars are insulated from core to improve motor efficiency.

GENERAL ELECTRIC

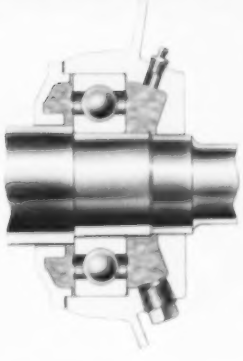
Motors in New NEMA Ratings

TO 125 HP

TOTALLY ENCLOSED

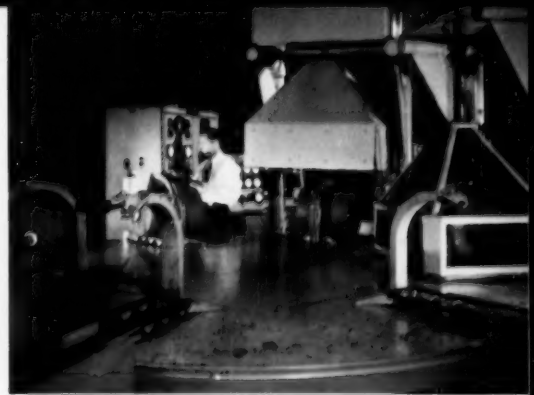


LONGER LIFE, EASIER MAINTENANCE



BEARING SYSTEM uses over-size ball bearings, synthesized grease, long, close-running seals to extend motor life.

PERMA-NUMBERED LEADS and roomy conduit box facilitate motor hook-up. Knock-off lugs speed end shield removal for motor inspection.

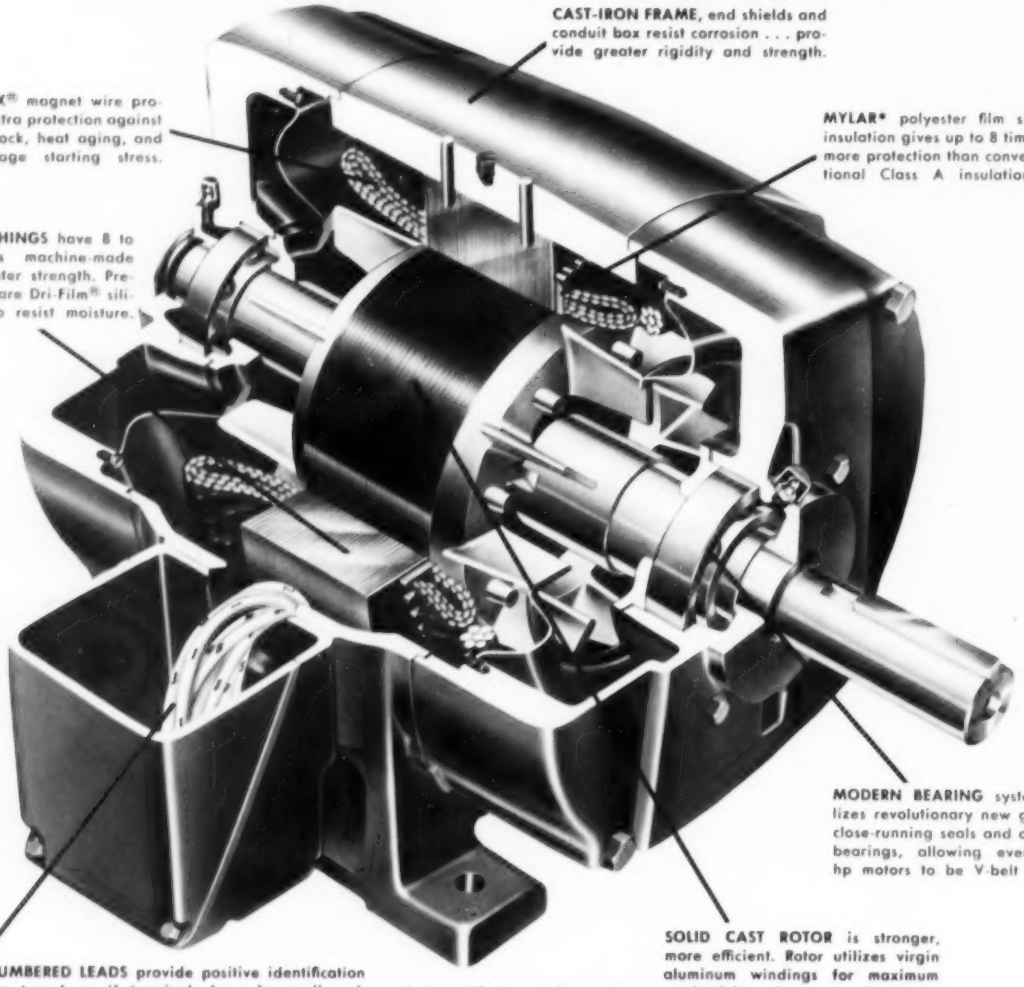


GENERAL ELECTRIC Tri-Clad '55' motors must pass a series of sound, vibration and hi-potential tests prior to shipment. Rigid tests assure uniform high-quality, and long-life performance.

TRI CLAD motors give you top performance. Here's why . . .

compact . . . power-packed

Only G-E TRI 55 CLAD motors give you all these years-ahead benefits



CAST-IRON FRAME, end shields and conduit box resist corrosion . . . provide greater rigidity and strength.

FORMEX® magnet wire provides extra protection against heat shock, heat aging, and full-voltage starting stress.

MYLAR* polyester film slot insulation gives up to 8 times more protection than conventional Class A insulations.

STATOR PUNCHINGS have 8 to 16 continuous machine-made welds for greater strength. Pre-wound stators are Dri-Film® silicone-treated to resist moisture.

MODERN BEARING system utilizes revolutionary new greases, close-running seals and oversize bearings, allowing even 125-hp motors to be V-belt driven.

SOLID CAST ROTOR is stronger, more efficient. Rotor utilizes virgin aluminum windings for maximum conductivity, better performance.

PERMA-NUMBERED LEADS provide positive identification even when taped, or if terminals have been clipped.

*Registered Trade-mark Dupont Co.

FOR COMPLETE INFORMATION

Section 891-3
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN** (GEA-6602) describing the many advanced features of new Tri-Clad '55' motors up to 125-hp.

☐ **FREE SLIDE RULE** (GEN-148) to determine weight and space-saving benefits of new Tri-Clad '55' motors.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY & STATE _____

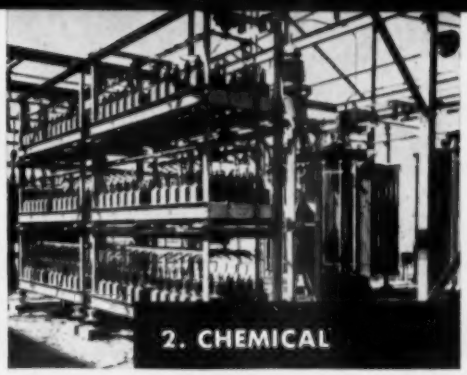
FOR COMPLETE DETAILS on the new line of Tri-Clad '55' motors up to 125 hp, contact your local G-E motor distributor or the motor specialist at your nearby General Electric Apparatus Sales Office. They will give you expert assistance in selecting and applying the right motor for your particular application.

For free slide rule to determine weight and space-saving benefits of the new motor, and for informative General Electric Tri-Clad '55' motor bulletin, please send attached coupon.

Progress Is Our Most Important Product

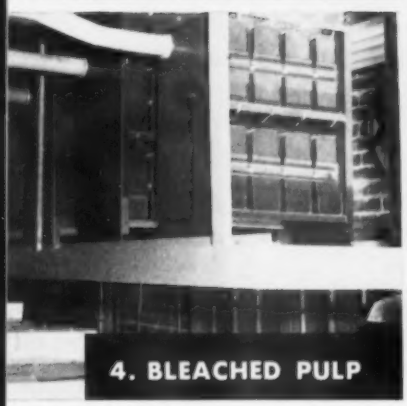
GENERAL ELECTRIC

1. STEEL

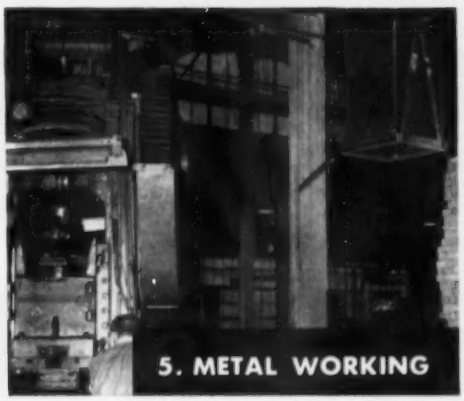


2. CHEMICAL

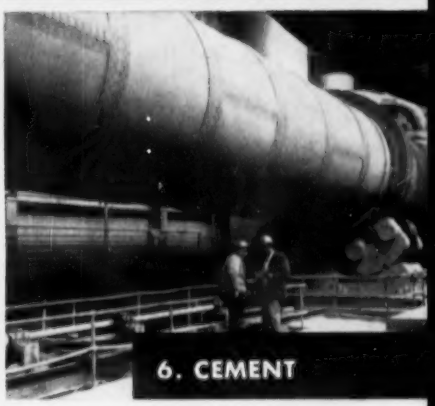
3. TEXTILE



4. BLEACHED PULP



5. METAL WORKING



6. CEMENT

HERE'S HOW GENERAL ELECTRIC CAPACITORS ARE PAYING DIVIDENDS FOR SIX INDUSTRIALS

Here are the stories of six manufacturers who are now realizing high return on investment in terms of dollar savings, increased circuit capacity and better plant operating conditions by installing G-E industrial capacitors.

1. *Atlantic Steel Company, Atlanta, Georgia,* converted from line shaft drives to individual motor drives on its nail-making machines. Installation of 45 G-E 4-kvar capacitors at the motors helped make changeover possible by removing power factor problems arising from high motor starting torque.

2. *Shea Chemical Corporation, Columbia, Tennessee,* purchases its power on the basis of kilowatt demand with a sliding price scale for amounts over 29,000 kw. Installation of G-E capacitors helped raise power factor to 93.4% —saving Shea approximately $1250 a month in electric utility demand charges.

3. *Pepperell Manufacturing Company, Lindale, Georgia,* now saves an estimated $15,000 a year in power costs. General Electric capacitors helped raise Pepperell's plant power factor from 75% to better than 97%, enabling its utility to grant a lower rate.

4. *Riegel Paper Corporation, Carolina Division, Acme, North Carolina,* released an additional 1875 kw capacity by raising plant power factor from 82% to 95% with G-E industrial capacitors. Other benefits for Riegel were relief of overloaded load centers and postponement of the need to buy additional distribution and generating equipment.

5. *Empire Plow Company, Cleveland, Ohio,* paid off its capacitor investment of $1907 in just eight months, out of *power bill savings.* After 240 kvar of capacitors were installed, power factor rose to better than 97%. Improvement in power factor meant real savings in power bills.

6. *Peerless Cement Company, Detroit, Michigan,* needed additional power from its generating equipment because expanded facilities called for increased motor load throughout the plant. Installation of G-E capacitors raised power factor from 92% to 96%, allowing present generating facilities to handle the growing motor load and increasing the carrying capacity of previously overloaded feeders.

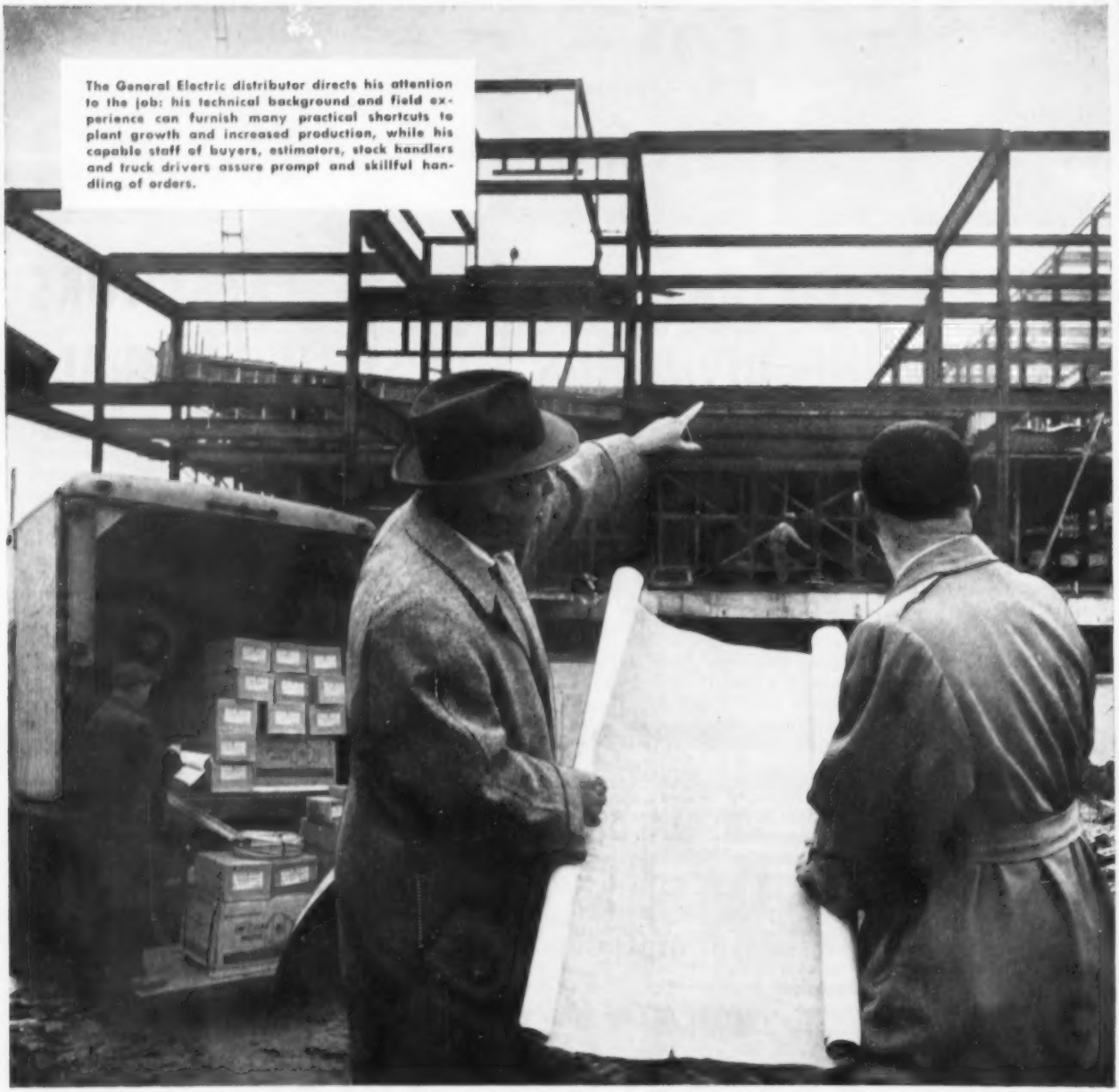
No matter where you are, no matter what you manufacture, General Electric capacitors may be able to give you dollar savings, increased system capacity, or improved operating conditions. Ask your G-E sales engineer how capacitors can be of specific benefit in your plant. For more information, write for bulletin GED-2978, "The Capacitor Digest," Section 441-114, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

How General Electric Apparatus Distributors help you plan for growth

The training, experience and resources of your G-E distributor can make plant expansion easier, faster and more economical



The General Electric distributor directs his attention to the job: his technical background and field experience can furnish many practical shortcuts to plant growth and increased production, while his capable staff of buyers, estimators, stock handlers and truck drivers assure prompt and skillful handling of orders.

1. The distributor knows the shortcuts that can save dollars on equipment and installation costs. Your General Electric distributor knows the electrical business: his past experience, his thorough training in General Electric schools, his supply of up-to-date buying information and his day-to-day contact with the practical problems of his trade provide him with a knowledge of the best way to apply and install electrical equipment. And he brings this acquired "insight" to your problems.

Not a moment is lost in filling your order.

Equipment is delivered on time.

2. His close contact with the problems of others helps to eliminate many of yours at the very start. Many problems on the choice and application of equipment that are new to you are routine to the distributor. If you show him your plans early enough, he can often save engineering time—and, in some cases, actual building costs. In instances, where the solution is beyond his experience, he can turn to the combined resources of the General Electric Company.

3. The distributor offers important advantages of "one-stop buying." His well-stocked warehouse gives you an almost unlimited choice of the most modern electrical equipment—*most of it on demand or 24-hours shipment*. The specials that he does not have, he can quickly get through immediate contact with General Electric factories. In the case of hard-to-find needed-at-once items, the distributor's knowledge of the local market can often uncover the product you want in a hurry, saving you time and often, money.

4. The time to use the distributor's dollar-saving services is in the beginning. In the planning stages, he provides new equipment data, prices and special application information for estimate purposes. He works closely with your architect, contractor or consulting engineer. Should special problems arise, he calls in G-E specialists to help you. Thus, the distributor's service, properly used, can relieve you and your technical staff of many costly, time-consuming operations.

To make the most of your distributor's services, have a talk with him; let him show you how he can help you plan for growth. If you don't know your distributor's name, write National Manager, Distributor Sales, General Electric Company, Schenectady 5, New York. 340-35

"On site" suggestions can often save time and money.

These Are Some of the Products Sold by General Electric Apparatus Agents and Distributors

- fractional-hp motors
- gear-motors ¼ to 100 hp
- distribution and power transformers
- instrument transformers
- arresters
- CLF fuses
- cutouts
- electric instruments
- time switches
- heaters and soldering irons
- watthour meters and sockets
- air circuit breakers
- switchgear
- rectifiers
- capacitors
- substations
- Inductrol® voltage regulators

*Trade-mark General Electric Co.

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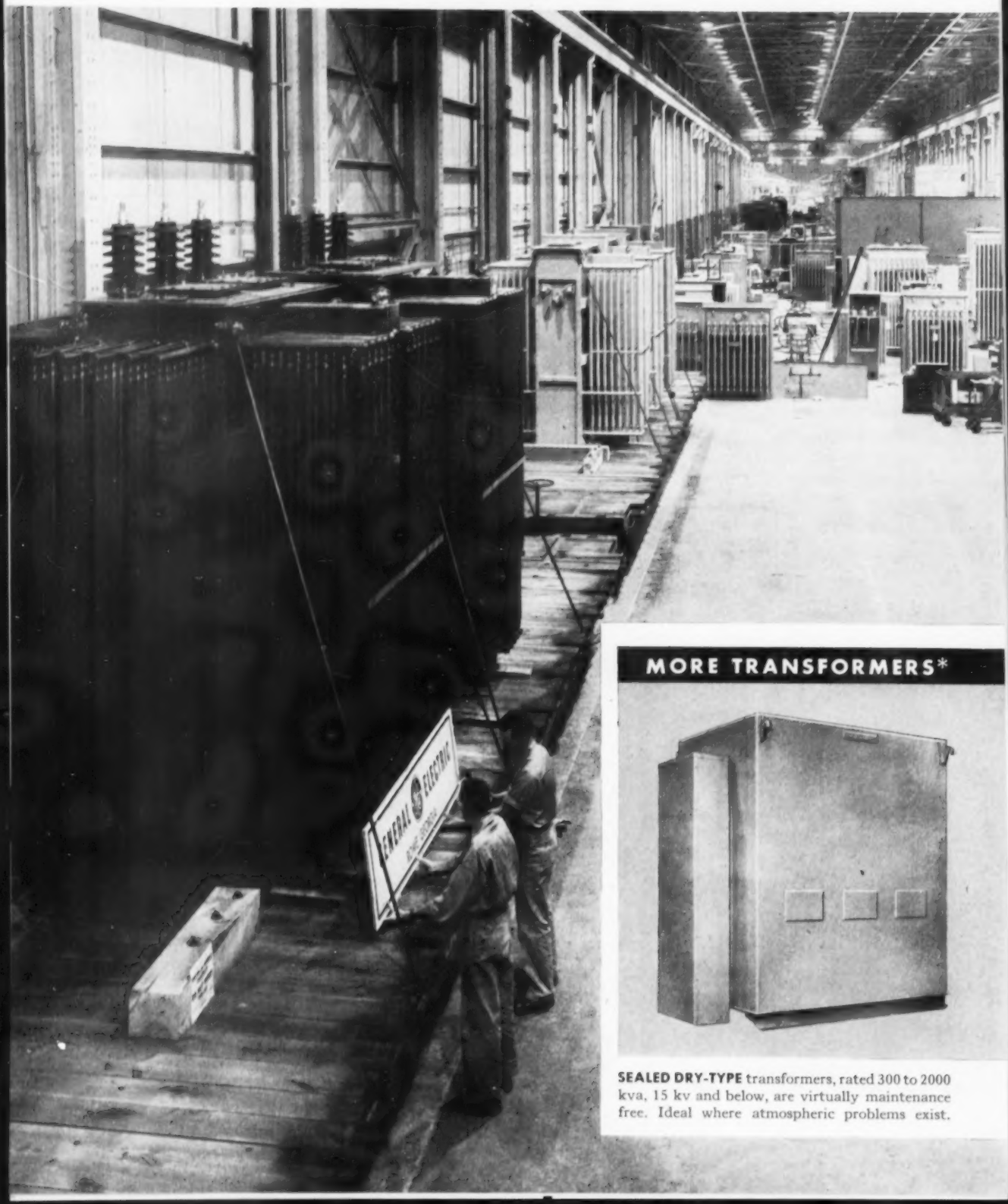
GENERAL ELECTRIC

NOW....10-week shipment of



MORE TRANSFORMERS*

SEALED DRY-TYPE transformers, rated 300 to 2000 kva, 15 kv and below, are virtually maintenance free. Ideal where atmospheric problems exist.

General Electric RM medium transformers

If your new or modernized plant power system calls for transformers 501 to 7500 kva, 69 kv and below, you'll benefit by faster shipment from General Electric. These RM medium transformers are currently being shipped in only 10 weeks from order date.

Standard-design transformers plus the General Electric repetitive manufacture process make possible this fast shipment. Standardization eliminates engineering and design time required for special units. Repetitive manufacture brings highly efficient production-line techniques to transformer production.

You benefit from standardization without sacrificing versatility. Voltage ratings and optional features are available for most industrial needs.

MORE RM MEDIUM TRANSFORMER BENEFITS:

Faster delivery is only one of the outstanding benefits you'll receive. Here are more:

Reduced maintenance, longer life—control-center arrangement of indicators, full-drain feature, and many other features help minimize routine inspection time. Quality materials, plus continuous quality control during manufacture, assure greater reliability on the job.

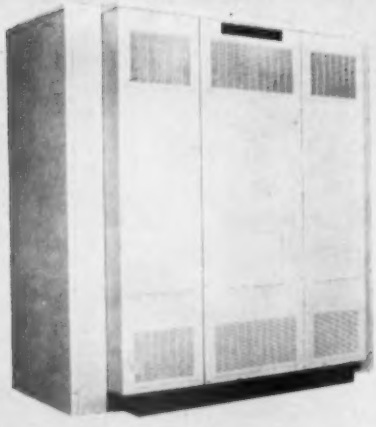
Faster, less expensive installation—shipped completely assembled, RM medium transformers have features such as ski-tip bases, extra jacking space, and reversible junction boxes which can cut installation time to only four hours.

Before you buy a medium transformer, contact your nearest General Electric Apparatus Sales Office. You'll discover how faster shipment, easier installation, reduced maintenance, and longer life add up to more for your transformer dollar. General Electric Company, Schenectady 5, New York. 416-13

Progress Is Our Most Important Product

GENERAL ELECTRIC

FOR INDUSTRIAL USE FROM THE COMPLETE GENERAL ELECTRIC LINE

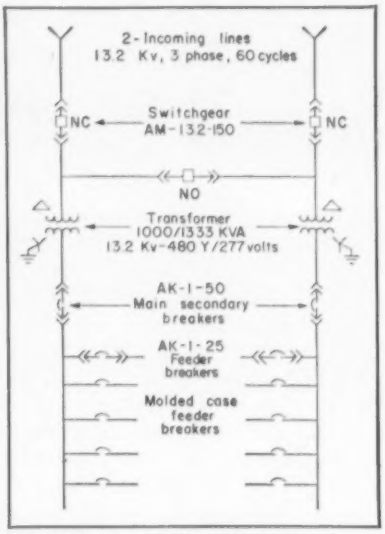


OPEN DRY-TYPE transformers, rated 300 to 2000 kva, 15 kv and below, are used in clean, dry, indoor locations where weight or floor space problems exist. Light enough to mount overhead!

LIQUID-FILLED transformers, rated 112½ to 500 kva, 15 kv and below, conveniently and economically supply small blocks of power. Outdoor units are oil-filled; indoor, Pyranol†-filled.

†*Reg. Trade-mark of General Electric Co.*

**These same transformers are also incorporated in General Electric's outstanding line of load-center and distribution-center unit substations.*



AS MODERN AS TOMORROW, the Sheraton Hotel combines this highly efficient 480Y/277-volt electrical distribution system with forward-looking construction.

INCOMING SERVICE AT 13.2 KV is reliably handled by easy-to-maintain G-E metal-clad vertical lift switchgear.

SAFER G-E panelboards with molded-case circuit breakers are designed to occupy little space, permit easy wiring. They are installed in wiring closets.

General Electric 480Y/277-Volt Distribution System Permits $50,000 Savings at New Sheraton Hotel

MODERN HOTEL COMBINES FLEXIBLE LOAD CENTER SYSTEM, HIGH VOLTAGE LIGHTING TO CUT EQUIPMENT, INSTALLATION COSTS

Rising 22 floors above Philadelphia's Penn Center, the ultra modern Sheraton Hotel combines the latest in construction details with an efficient high voltage electrical power distribution system which is currently being installed in many commercial buildings.

Designed to provide maximum comfort and services for hotel guests, the new Philadelphia Sheraton Hotel has incorporated a General Electric 480Y/277-volt electrical system which permitted savings of $50,000. To design this modern system, G-E engineers worked closely with consultants Slocum and Fuller; and architects Perry, Shaw, Hepburn, and Dean. The electrical contractor was Keystone Engineering Corporation. One feature of the system is the installation of G.E.'s new quiet, dry-type, general purpose transformers. These low-noise-level transformers add further comfort for Sheraton Hotel guests.

From primary switchgear at the incoming line through secondary distribution and protective apparatus, General Electric system-engineered equipment provides highly reliable power at the Sheraton.

To see how General Electric can help you achieve significant savings with a 480Y/277-volt electrical distribution system, consult your nearest G-E Apparatus Sales Office or write to General Electric Company, Section 680-11, Schenectady, N. Y.

Engineered Electrical Systems for Commercial Buildings

GENERAL ELECTRIC

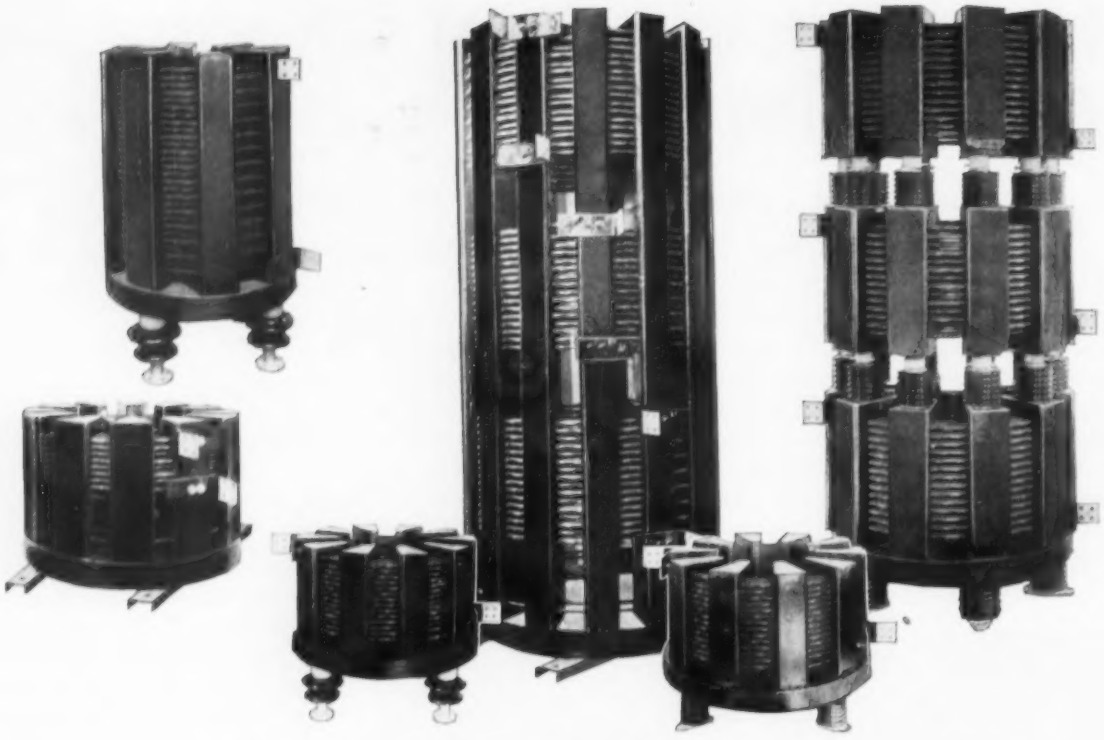
FLEXIBLE double-ended load center unit substation with integrated units furnishes highly dependable power close to load.

COMPACT low voltage switchgear and distribution switchboard protect low voltage side of "packaged power" system.

QUIET General Electric dry-type transformers, with low-noise-level characteristics, help improve sleeping comfort for Sheraton guests.

DECORATIVE LIGHTING enhances main ballroom. High voltage lighting in many areas of hotel permits low-cost use of combined light and power system.

COORDINATING THE PROJECT were M. Savitt of Slocum and Fuller, H. Cohen and L. Evelev of Keystone, T. S. Duff of Slocum and Fuller and A. M. Cook, G.E.



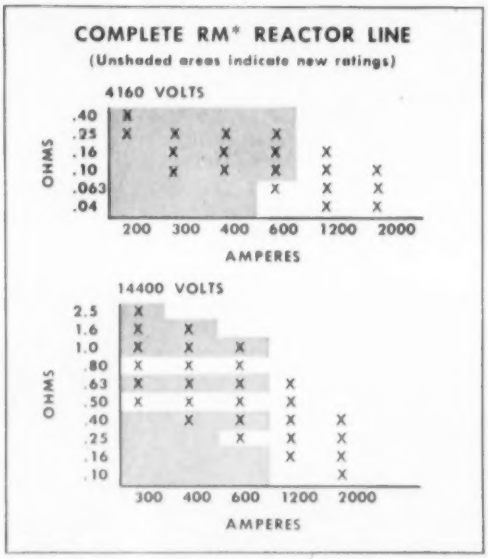
General Electric offers 8% lower prices, faster delivery in 24 new ratings of RM* reactors

8% PRICE REDUCTION and two to three weeks shorter shipment, possible for years with G.E.'s Repetitive Manufacture (RM) reactors, are now available in 24 new ratings up to 2000 amperes in both the 4160- and 14,400-volt classes. This means major savings in your most-required protective ratings.

RM REACTORS HELP PROTECT COSTLY EQUIPMENT and reduce system expansion costs by helping limit short-circuit currents to the capacity of other components. For this reason, G.E.'s reactor ratings are designed to coincide with the standard short-circuit ratings of switchgear, regulators, and other system equipment.

OPPORTUNITIES FOR SAVINGS exist throughout your system. Feeder protection, bus sectionalizing, bus synchronizing, and neutral grounding are only a few of the applications where G.E.'s complete line of reactors can help reduce equipment investment. Full details are available from your G-E Sales Engineer or from Section 422-38, General Electric Co., Schenectady 5, N. Y.

*Repetitive Manufacture



Progress Is Our Most Important Product

GENERAL ELECTRIC

Mr. Winters discusses the details of every home he builds with the people who will be living in it. Telephone facilities are planned for the future as well as the present.

"Concealed telephone wiring belongs in personalized homes"

—says Mr. O. C. Winters, Custom Builder of Indianapolis, Indiana

"It's good business to give customers what they need," says Mr. Winters, "and that includes concealed telephone wiring. The desire for planned and built-in telephone facilities is growing markedly. It's part of the trend of the times towards more livable homes.

A home built by Mr. Winters. Concealed telephone wiring is one of its distinguishing sales features.

"People are discovering that concealed telephone wiring preserves the beauty of their rooms as well as adding great convenience. They're favorably impressed with the architect or builder who plans on it for them.

"Concealed telephone wiring belongs in personalized homes, and I know from experience that it helps sell them."

• • •

Your nearest Bell Telephone business office will help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

Working together to bring people together

BELL TELEPHONE SYSTEM

Outstanding Performance...

Republic ELECTRUNITE E.M.T. was used extensively by Cawthon Electric Company, Tallahassee, Florida, in the construction of the new Florida State University gymnasium building. Center, close-up of the Republic ELECTRUNITE E.M.T. installation.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

with Republic ELECTRUNITE E.M.T.

The Best Costs LESS INSTALLED

Outstanding performance is nothing new at Florida State University where students may take a course in circus performance as part of their physical education training.

During recent months, Republic ELECTRUNITE E.M.T. has been used extensively in classroom and dormitory construction to meet the demands of the expanding campus. Cawthon Electric Company, Tallahassee, Florida, was the electrical contractor for the new gymnasium as well as several other buildings.

Why does Mr. T. L. Cawthon specify Republic ELECTRUNITE E.M.T. for much of his work? The answer is, "outstanding performance".

Republic ELECTRUNITE® E.M.T. "INCH-MARKED"® and "GUIDE-LINED"—easy to measure, easy to bend, easy to install! Accurate measuring and bending reduces over-all construction costs—gets the job done on schedule.

With the "GUIDE-LINE", which extends the full length of the raceway, simply align the arrows on the calibrated Republic E.M.T. Bender and apply minimum pressure. Bends are true and accurate—eliminate costly "wows", wasted time, and wasted materials.

ELECTRUNITE E.M.T. is made of Republic flat-rolled, open-hearth steel, and formed into a conduit by the famed electric resistance welding process. Close quality control of the basic material and the tube manufacturing process results in outstanding features: close tolerances for joining with couplings and fittings . . . uniform ductility for bending . . . galvanized coating that will not chip or flake.

Specify Republic ELECTRUNITE E.M.T. on your next job and enjoy its many economies. Write today for additional information, or call your Republic ELECTRUNITE distributor.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-4239
212 EAST 131ST STREET • CLEVELAND 8, OHIO

Gentlemen:
Please send me additional information on Republic ELECTRUNITE "INCH-MARKED" and "GUIDE-LINED" E.M.T.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Diamond "Red D"

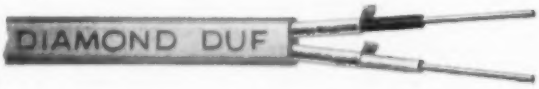
WIRE and CABLE

YOU KNOW THEM, YOUR CUSTOMERS KNOW THEM AS QUALITY PRODUCTS

Accepted as one of the best in the industry, Diamond Wire products have earned this reputation through a continuing program of production control, research and product development. Your order on any Diamond product triggers immediate action . . . maximum service to you.

First portable cord for mill and plant use designed with tough, oil-resistant Type MD* neoprene sheath in Industrial Red for ready Identification. *(Mill Duty).

Type MD* (Mill Duty) RED-D-Prene®



Thermoplastic insulated and jacketed non-metallic sheathed cable. Retards flame and has excellent resistance to moisture, corrosion, fungus, abrasion. Listed by UL.

Diamond DUF* Type UF

Non-sticking, smooth and easy to pull, Diamond DTX will not flake off. Moisture and flame resistant, it is clean to handle and strips easy.

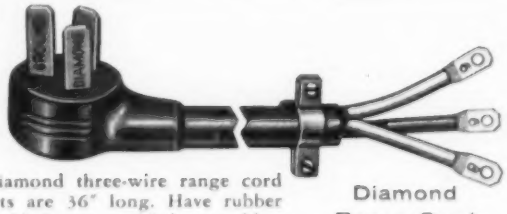
Diamond DTX® Non-Metallic White Sheathed Cable

Flexible steel armored cable ideally suited for general lighting and wiring in non-fireproof homes. Available in two, three and four conductor.

Diamond ABC Armored Bushed Cable

May be used without conduit from pole to building and down side of building in places not subject to mechanical injury. Listed by Underwriters' Laboratory.

Type SE Service Entrance Cable (Armored and Unarmored)



Diamond three-wire range cord sets are 36" long. Have rubber molded cap, molded on rubber jacketed cable—are complete with steel strain relief. UL approved.

Diamond Range Cord Set

Trade Mark ®

DIAMOND

WIRE and **CABLE** Company

Sycamore, Illinois

WAREHOUSE: BIRMINGHAM, ALABAMA

How to select a Remote Control Switch

Electrical engineers are increasingly incorporating Remote Control Switches into their wiring layouts and circuits. Remotes today are used not only for the instantaneous control of emergency equipment, where they are a *must*, but for safety, economy and convenience wherever light or power is being distributed over a wide area.

Selection of Type

The selection of the right remote for a particular application must be given some study, but basically there are only two factors which affect the selection of type: (1) the class of load: non-inductive, such as heaters and lighting; or inductive, such as motors; (2) the voltages of the systems used.

Mixed Loads

Where there are mixed loads, non-inductive load rating must not be less than the combined full-load currents nor less than 66⅔% of the maximum current to be interrupted.

Any connected motors should be evaluated on the basis of stalled rotor current, using the multiplier of six times motor current if the actual value is not known. These currents added to the non-inductive load current will establish the maximum current which the switch will have to interrupt. In specifying the switch capacity, give class of the load and the amount of the load which is to be controlled.

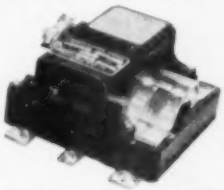
Why Mechanically Held

Another important selection-factor is that the remote control switch be mechanically held. Because it is essentially a feeder disconnect, the remote must be unaffected by line voltage conditions and respond only to control of the push buttons. ASCO mechanically held remotes insure against outages on vital circuits caused by momentary line voltage dips.

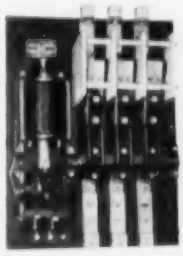
A detailed report on the advantages of ASCO remote control switches can be obtained by writing for new catalog 57-S2.

A selection of basic Remote Control Switches by ASCO

For Economy and Rugged Construction . . .



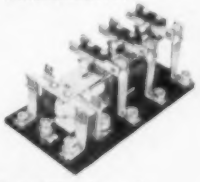
Use the Bulletin 920 — Up to 3 Poles, Single Throw, 30-75 Amps D-C, 30-200 Amps A-C. U.L. Approved to 600V A-C, 250V D-C. Recommended for all loads within its capacity range.



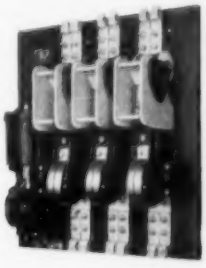
For Load Requirements Exceeding Capacity of the Bulletin 920 . . .

Use the Bulletin 910—Up to 4 Poles, Single Throw, 30-400 Amps, 250 volts, A-C.

For Small Panelboards . . .



Use the Bulletin 909 — Up to 5 Poles, Single Throw, 3 Poles, Double Throw, 30 Amps, 250 volts, A-C or D-C.

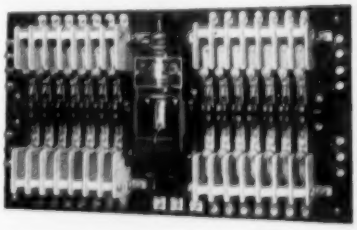


For High Capacity, Highly Inductive Loads . . .

Use the Bulletin 911—Up to 4 Poles, Single Throw, 30-1000 Amps, 600 volts, A-C, 250 volts, D-C.

For Multiple Pole Requirements . . .

Use the Bulletin 915—Up to 24 Poles, Single or Double Throw, 30, 60 and 100 Amps, A-C.



ASCO®

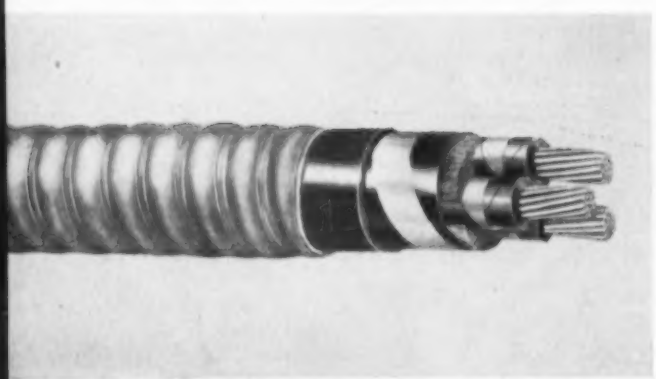
Automatic Switch Co.

50-J Hanover Road, Florham Park, New Jersey

FRontier 7-4600

For air conditioning: Three conductor, 500 Mcm, 37 wire, $\frac{6}{64}$" varnished-cambric insulated Anaconda Duralox Cable was quickly, easily installed in older building

PROBLEM: Installing new circuits in old building

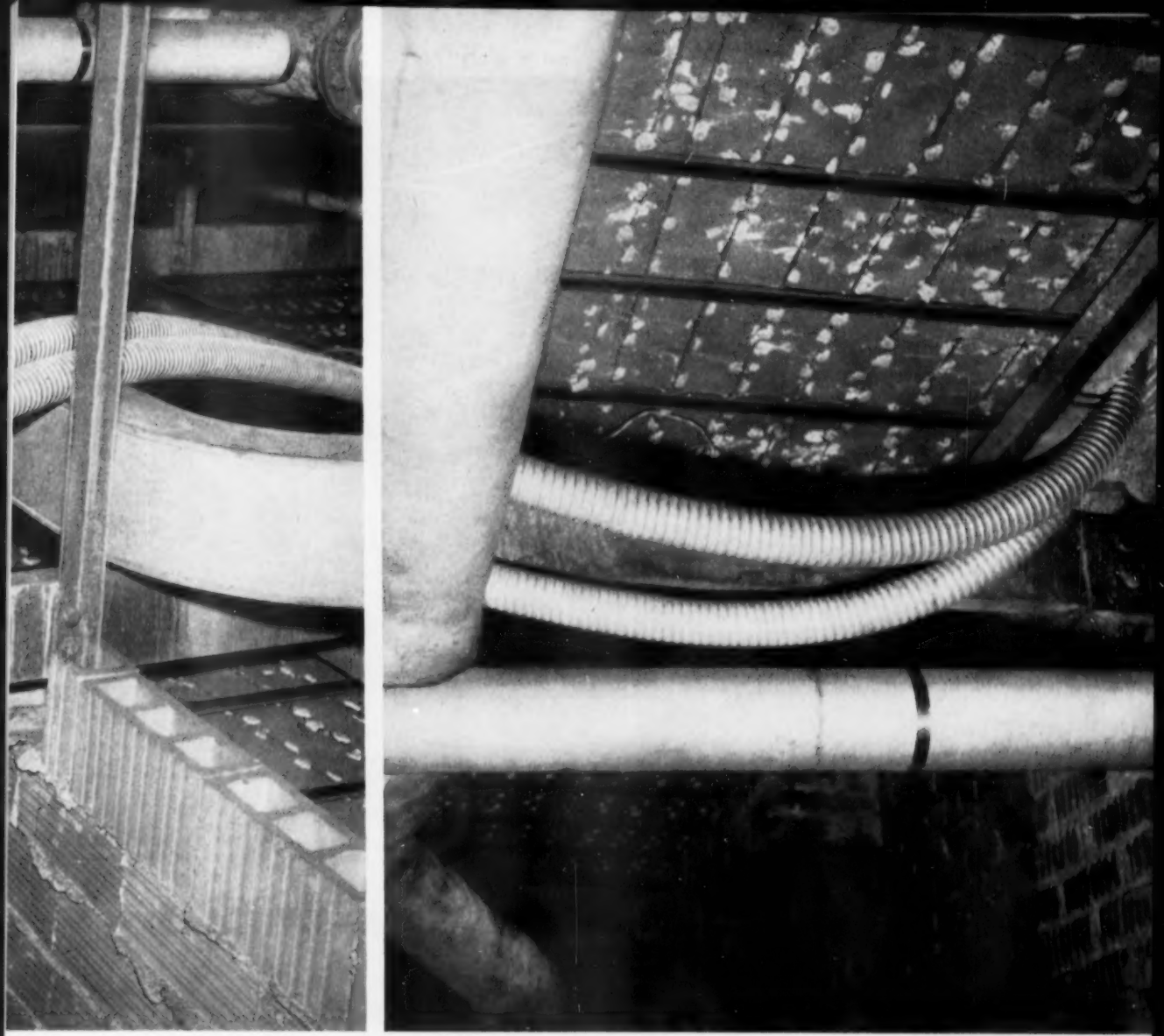


Anaconda Duralox Interlocked-armor Cable.

Installing new circuits in an old building — whether for air conditioning, as the case here, or for new machinery or new load centers — can be tough and costly. You either have to go around existing obstructions, a laborious job with rigid conduit, or remove them.

The ideal solution is Anaconda Duralox Interlocked-armor Cable.

Because it is flexible, Duralox Cable is quick, economical to install — indoors or out — with simple supporting devices. It trains easily around corners, columns and other obstructions in *long, unbroken*



to handle new load. Cable runs from breaker box in west wing (left) through loft of roof (center) to side wall of building and down wall (right) to breaker box on lower floors.

SOLUTION: Duralox Interlocked-armor Cable

or: *How to do a hard job the easy (and low-cost) way*

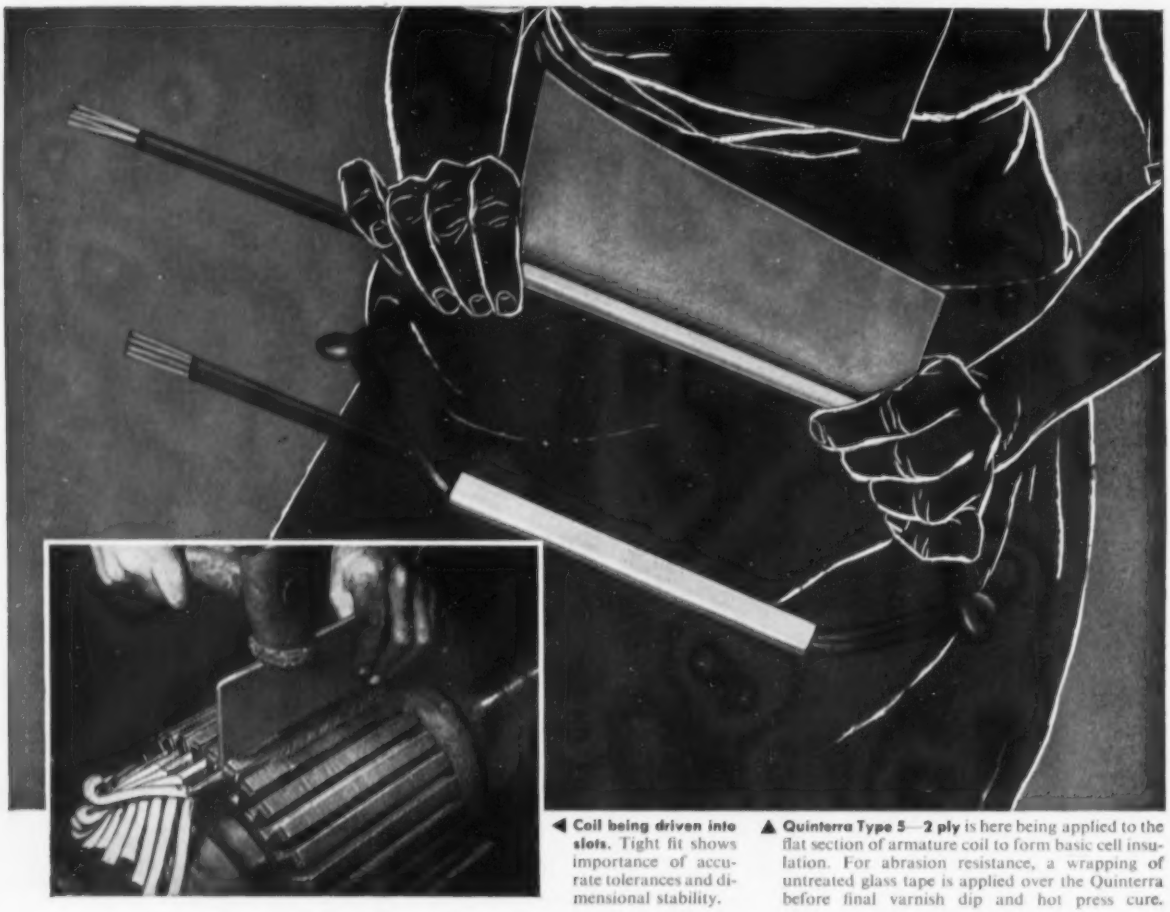
runs. Circuits are easy to relocate . . . always accessible. Duralox's interlocked metal-tape armor affords excellent protection against mechanical damage.

Anaconda Interlocked-armor Cable is available in sizes No. 6 Awg to 750 Mcm — copper or aluminum conductors — up to 15 Kv. Underwriters' approved for 600 volts and 5000 volts. With rubber, plastic, or varnished-cambric insulation.

NEW BULLETIN DM 5606 on Anaconda Duralox Cable gives you full information. Write for your copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

ASK THE MAN FROM **ANACONDA®**

FOR **INTERLOCKED-ARMOR CABLE**



◀ **Coil being driven into slots.** Tight fit shows importance of accurate tolerances and dimensional stability.

▲ **Quinterra Type 5—2 ply** is here being applied to the flat section of armature coil to form basic cell insulation. For abrasion resistance, a wrapping of untreated glass tape is applied over the Quinterra before final varnish dip and hot press cure.

Why West Virginia Armature Co. switched to J-M QUINTERRA® *for armature coil insulation*

West Virginia Armature Co., Bluefield, W. Va., is a leading manufacturer of motor armature coils, used by the coal mining industry—a severe and difficult field. It was only after 4 years of field testing that they decided to change to Johns-Manville Quinterra Type 5—2 ply for their traditional built-up insulation materials. They made this change because they discovered that:

1 Quinterra retains higher inherent dielectric strength under prolonged high temperature operating conditions.

2 Quinterra, manufactured to closer thickness tolerances, permits more accurately dimensioned coils, assuring easy and proper fit.

3 Quinterra is pliable, conforms readily to shape of coil and remains dimensionally stable in storage or in use.

4 Quinterra is smooth, does not crack or flake, is easy and pleasant to handle, does not harm or irritate operators' hands.

5 Quinterra is flexible, eliminates dielectric failures due to flaking or splitting.

Quinterra Type 5—2 ply is made from two sheets of highly purified asbestos treated with a polyvinyl acetate resin saturant and combined under controlled temperature and pressure. It has ample mechanical strength for easy handling. Its inherent dielectric strength exceeds 280 VPM even at temperatures over 130 C.

Find out how you can obtain the same benefits from Quinterra. Write for free 32 page illustrated brochure, EL-40A. Address Johns-Manville, Box **14,** New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Dimensional accuracy is imperative. Here, finished coils are being tested in Go-or-No-Go gauge.

Johns-Manville ELECTRICAL INSULATIONS

whatever the job . . .

SELF-STICKING

PERMACEL® TAPE

PERMACEL LEPAGE'S products

Permacel Tape Corporation, New Brunswick, N. J. • a Johnson & Johnson company

This Highly Efficient-Low Brightness Lighting for First National Stores Warrants "Food for Thought"

If anyone knows how to obtain *quality at sensible cost* it's America's mass merchandisers! Whether they are buying bread or bananas lean sirloins or LIGHTING they look for *value*.

We at Litecontrol are quite proud of this installation in the First National Stores Executive Office Building. The area shown is only one of the offices similarly illuminated throughout the building with Litecontrol recessed fixtures. The General Office uses a surface fixture system. Some of the fixtures like those in the photo were mounted in L-shaped patterns.

The recessed hinged curved lens fixtures do a completely functional job of providing ample lighting without glare. If *you* have a lighting job *for* a supermarket or *in* a supermarket* think of LITECONTROL for superb lighting with standard fixtures always.

**Also applies to libraries, schools, gymnasiums, churches, plants, hospitals.*

INSTALLATION:
First National Stores, Inc., Executive Offices, Somerville, Mass.
AREA SHOWN: Engineering Office
ENGINEERS AND ARCHITECTS:
Granteaume & McMullen, Boston, Mass.
ASSOCIATE ELECTRICAL ENGINEER:
Lionel G. Gale, Boston, Mass.
ELECTRICAL CONTRACTOR:
Lord Electric Company, Inc., Boston, Mass.
DISTRIBUTOR:
Graybar Electric Company, Inc., Boston, Mass.
CEILING HEIGHT: 9' 6"
FIXTURE SPACING: 4' on C. throughout
FIXTURES:
Litecontrol No. 9024RS 2-lamp troffers using Holophane No. 9033 and 9034 low brightness lenses.
INTENSITY:
Designed for minimum of 50 foot-candles in 16 foot-square offices, with correspondingly higher intensities in larger offices as above.

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

IT'S BUILT RIGHT– IT WORKS RIGHT– IT'S PRICED RIGHT

The Cutler-Hammer Midget Switch

Many electricians are now using this amazing Cutler-Hammer 4151 Midget Safety Switch wherever low cost circuit protection and control of electrical equipment is required . . . oil burners, air-conditioners, fans, automatic washers and dryers, home workshop power tools, blowers, and stokers are typical examples. Try a 4151 on your next job and you will agree this midget safety switch is built right, it works right, and it's priced right.

It's built right—Everyone is quick to appreciate the 4151's compact design, but of equal importance is its ease of installation. The one piece switch-and-fuse unit is removable by two screws for 3-point mounting of the enclosing case, speedy conduit connections, and wire pulling freedom. All terminals are out-front . . . no more skinned knuckles or wire "pretzel" bending.

It works right—Cutler-Hammer's 4151 Midget Safety Switch has solid silver, double break, butt type contacts. Silver contacts will outlast contacts of copper or bronze. Double break contacts have greater contact area and halve the arc voltage. Butt type contacts meet face-to-face and receive only a fraction of the wear common to other designs.

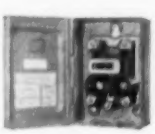
It's priced right—The 4151 is a quality safety switch, yet the price range is the same as the cheapest switches made.

Ask for a Cutler-Hammer 4151 Midget Safety Switch today. Stocked by your Authorized Cutler-Hammer Distributor and better electrical supply stores everywhere. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

4151H241 30 Amp. 2 wire S/N; 1 Fuse. 120 A-c. 2¼" x 5¼" x 2¼". List: $4.50

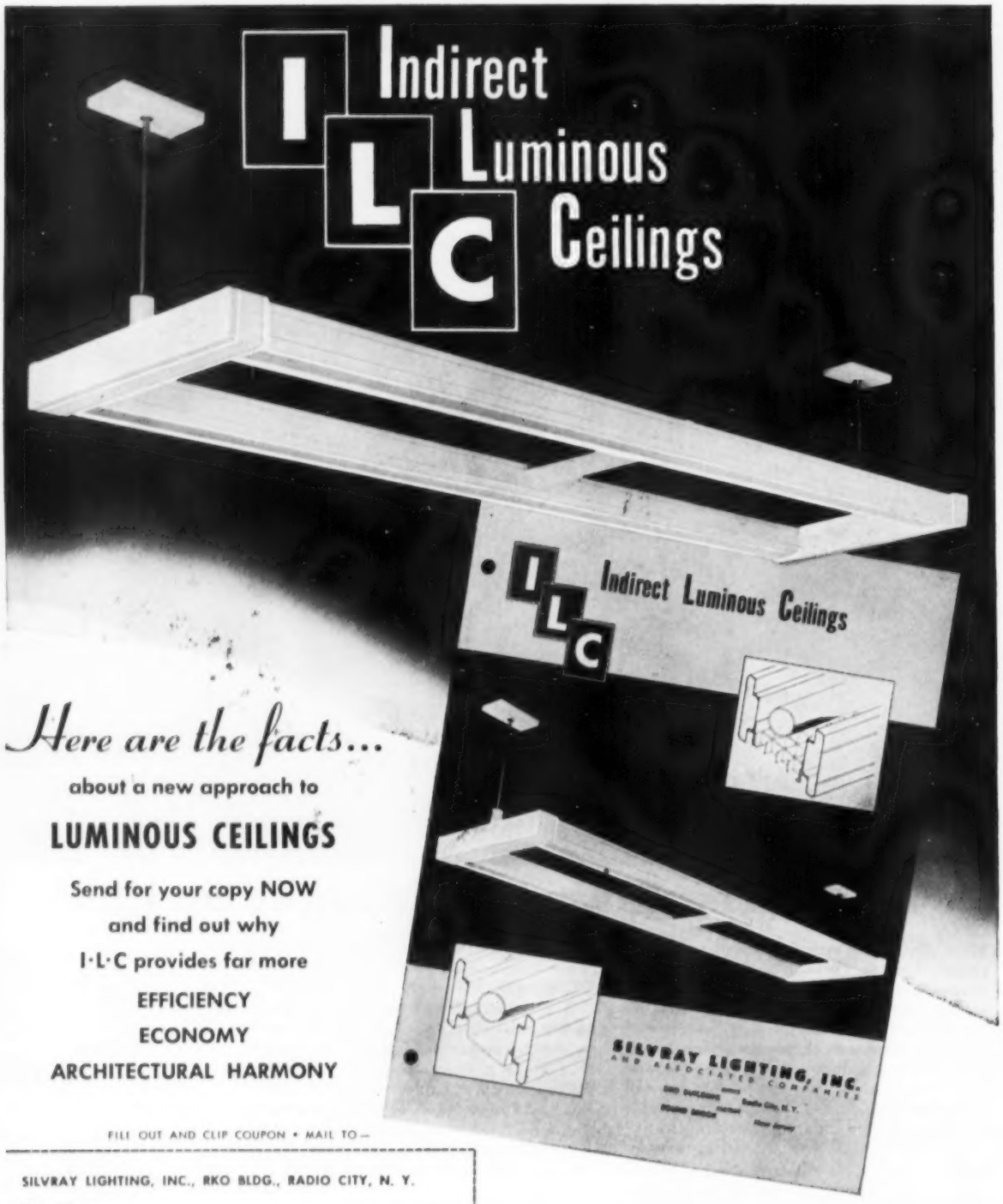
4151H201 30 Amp. 2 Pole; 2 Fuses. 120/240 A-c. 4" x 5¼" x 2¼". List $5.60

EXTRA VALUE
CUTLER-HAMMER
SAFETY SWITCHES
C-H
AT NO EXTRA COST



4151H341 30 Amp. 3 wire S/N; 2 Fuses. 120/240 A-c. 4" x 5¼" x 2¼". List: $5.90

I Indirect L Luminous C Ceilings



Here are the facts...

about a new approach to

LUMINOUS CEILINGS

Send for your copy NOW
and find out why
I·L·C provides far more
EFFICIENCY
ECONOMY
ARCHITECTURAL HARMONY

FILL OUT AND CLIP COUPON • MAIL TO—

SILVRAY LIGHTING, INC., RKO BLDG., RADIO CITY, N. Y.

Dear Sirs:

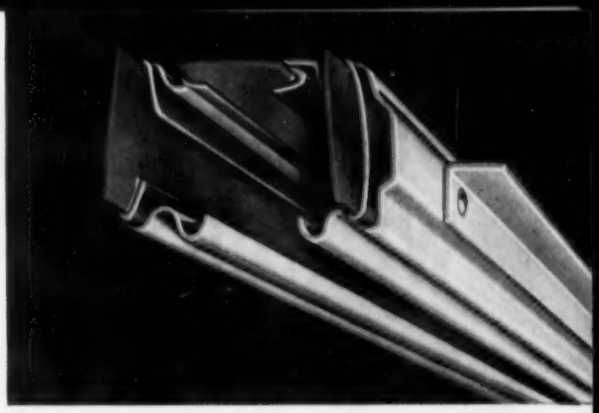
Will you kindly, without any obligation on my part, send me the ILC Booklet #S-457 with complete data on Indirect Luminous Ceilings.

NAME:_____

ADDRESS:_____

CITY:_____ STATE:_____

SILVRAY
LIGHTING, INC.
AND ASSOCIATED COMPANIES
RKO Bldg., Radio City, N. Y.



End view of new 3-wire duct. Polarizing bar on side of duct meets all code requirements for polarization. The duct is Underwriters listed, single phase, 3 wire, 120/240 V.

A BullDog field engineer will gladly point out the many advantages of Trol-E-Duct and other BullDog electrical equipment. You'll find his services most helpful from initial planning right down to final installation.

Big new development in lighting—3-wire Universal Trol-E-Duct!

BullDog's new 3-wire Universal Trol-E-Duct® is literally packed with money-making opportunities. It offers *twice* the load capacity of 2-wire systems . . . yet costs no more to install. It provides a constant circuit for night lighting and/or a separate circuit for wall or column receptacles. It permits the flexibility of staggering lighting circuits and is light weight, compact... requires less space than any other 3-wire system.

Like 2-wire Universal Trol-E-Duct, it is *completely flexible*. It both feeds and supports lights anywhere along its length. Lighting fixtures can be connected or disconnected with but a simple twist. You save installation time . . . provide customers with high-quality, flexible lighting they'll appreciate for years.

Get the full story. See your electrical distributor or call a BullDog field engineer.

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BullDog Electric Products Co., Detroit 32, Mich. • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, N.Y. • *In Canada:* BullDog Electric Products Company (Canada), Ltd., 80 Clayson Rd., Toronto 15, Ontario.

IF IT'S NEW... IF IT'S DIFFERENT... IF IT'S BETTER... IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

50,000 OPERATIONS WITHOUT A FAILURE!

Definite proof that FRANK ADAM type SAHD Shutlbrak Switches answer industry's need for a QUALITY heavy duty switch

That's the amazing record compiled by Frank Adam SAHD heavy duty Shutlbrak Switches in tests conducted recently at the company's Research Laboratories.

The tests were designed to determine the efficiency and stamina of the switches under the most exacting operating conditions. Tests included such factors as temperature, increased horsepower, die-electric and endurance.

"The results of the tests," says Floyd S. Green, chief of Frank Adam's Research and Development Laboratories, "was most gratifying. In 50,000 continuous operations —five times the requirement of the Underwriters' Laboratories, Inc.—there was not a single failure.

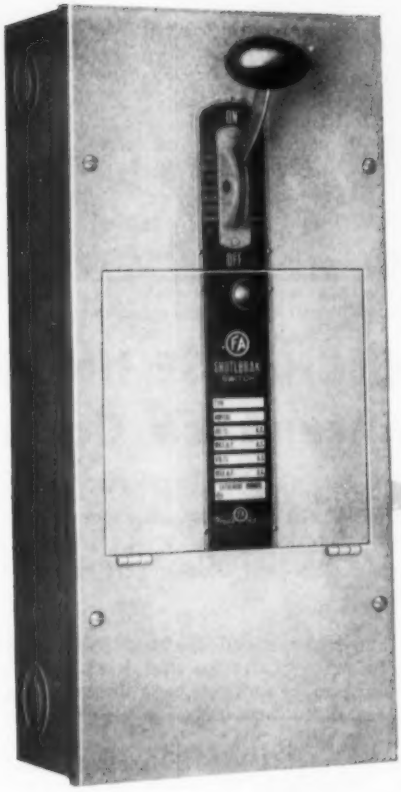
"Wear and tear on the switch at the conclusion of the tests was virtually negligible.

"The tests confirmed what we have always contended...that Frank Adam type SAHD Shutlbrak Switches thrive on work . . . that they are safe, dependable, long-lasting and trouble-free . . . and that they are unsurpassed for motor control, service entrance and any job requiring a heavy duty operating switch."

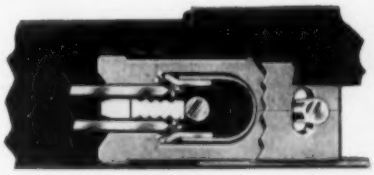
Take a tip from Mr. Green. Make your next heavy duty switch a Frank Adam type SAHD Shutlbrak Switch.

if it's FA . . . it's OK

Features that make FRANK ADAM Shutlbrak Switches outstanding

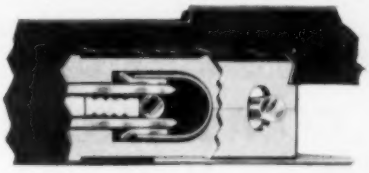


CONTACTS "MAKE" or "BREAK"



The only points at which arcing can occur are on the outside edges of the line and load blades when contacting the arcing tips.

CONTACTS "ON"



Full contact being made with the round main contact roller on the inside of the line and load blades.

Frank Adam Shutlbrak Switches are horsepower-rated, front-operated, heavy duty operating switches with quick-make and quick-break mechanism. All current carrying parts are heavily electro silver plated.

The dominant feature of the switches is the shuttle mechanism, including main contact roller, which rolls under pressure and improves with use. (See illustration). This fact was definitely proven in the tests by the highly polished silver surface of the main roller.

"Make" and "break" of current is done when the outside edges of the stationary contacts meet the arcing tips, thus preventing any burning or pitting of the main contact roller.

Type SAHD switch has an interlocking fuse door which automatically locks when the current is "on" and permits access when the switch is "off". (An intermediate position of operating handle provides access to authorized persons). The handle also is arranged with padlocks in the "on" or "off" position.

Capacities of the SAHD switch are; 30 to 1200 amperes with front operated handles, 250 volts AC or DC or 600 volts AC or DC in 2, 3 or 4 pole single throw.

Contact your nearest Ⓕ dealer or Ⓕ representative listed in Sweets for further details.

FRANK ADAM

FA

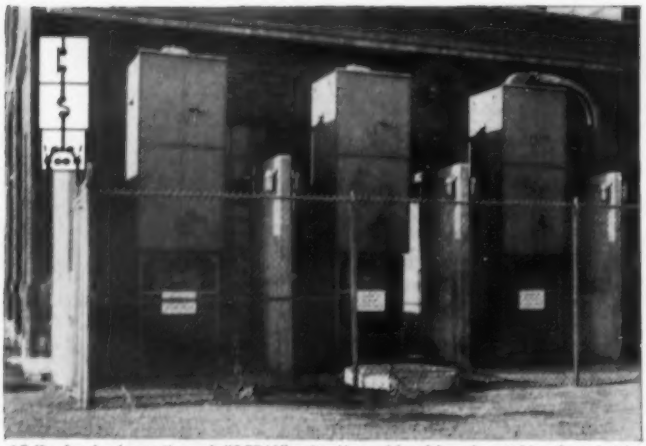
FRANK ADAM ELECTRIC COMPANY

BOX 357, MAIN P. O. • ST. LOUIS 3, MO.

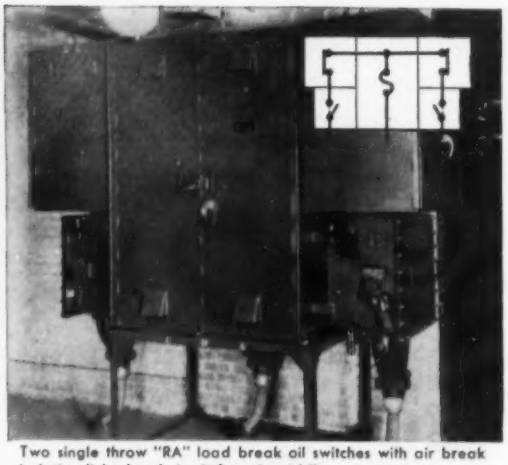
makers of

busduct • panelboards • switchboards • service equipment

safety switches • load centers • Quikheter



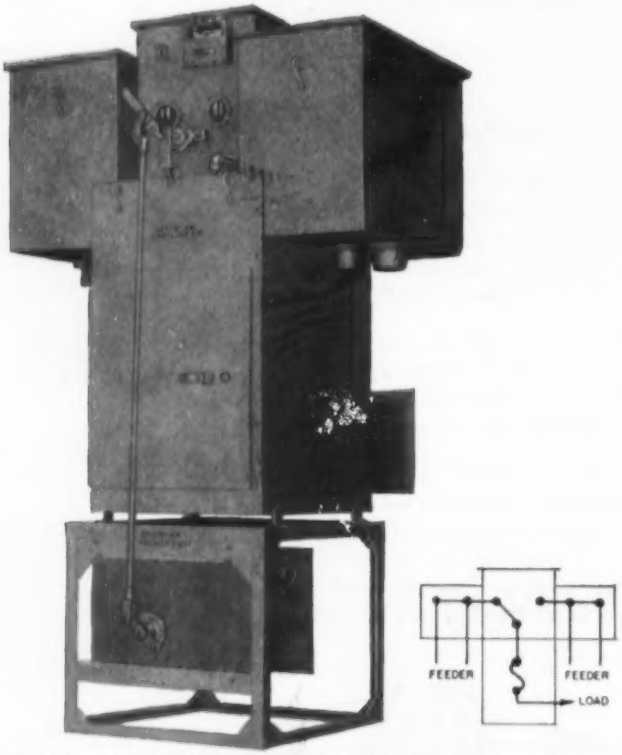
12 Kv. feeder loops through "SCRAL" units. Manual load break switching from inside of building. Isolating air break disconnects on load side of power fuses.



Two single throw "RA" load break oil switches with air break isolating links. Load circuit fuses in middle compartment.

G&W COMBINATION "SCRA" SWITCH-FUSE UNITS

Save Installation Labor & Maintenance Costs



A large industrial plant has 23 units as shown. 12.5 Kv. feeders loop through compartments on two sides of "RAD" double throw automatic transfer oil switch. Transformer (not shown) is attached to back of unit and fed through power fuses in middle compartment.

CD573

COMBINE IN ONE FACTORY ASSEMBLED UNIT—

- Load break "RA" oil switches for feeder selection or disconnection.
- Power fuses for load circuit protection or isolation.

Installation labor saved because it is only necessary to connect feeder and load cables.

Maintenance costs reduced by elimination of exposed buses, disconnects, etc.

G & W combination switch-fuse units are functionally designed for compactness and minimum cost. They are ordinarily custom built to meet individual requirements. They may be enclosed in straight line metal cabinets to match other equipment. USUAL RATINGS—400 AMPERES, 5, 7.5 & 15 Kv.

The "RA" load break oil switches may be one double throw or two single throw switch units—manually or automatically operated. Disconnecting links may be included on one or both sides of oil switches for air break isolation. Feeder and load cable potheads or terminating compartments for lead covered or neoprene jacketed cables may be located at top or bottom sides or back of the combination unit.

Call in our representative for recommendations of Switch. Fuse units to meet your requirements.

G&W ELECTRIC SPECIALTY CO.
3500 W. 127th Street, Blue Island, Illinois
Representatives in many cities of N. & S. America
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

G&W

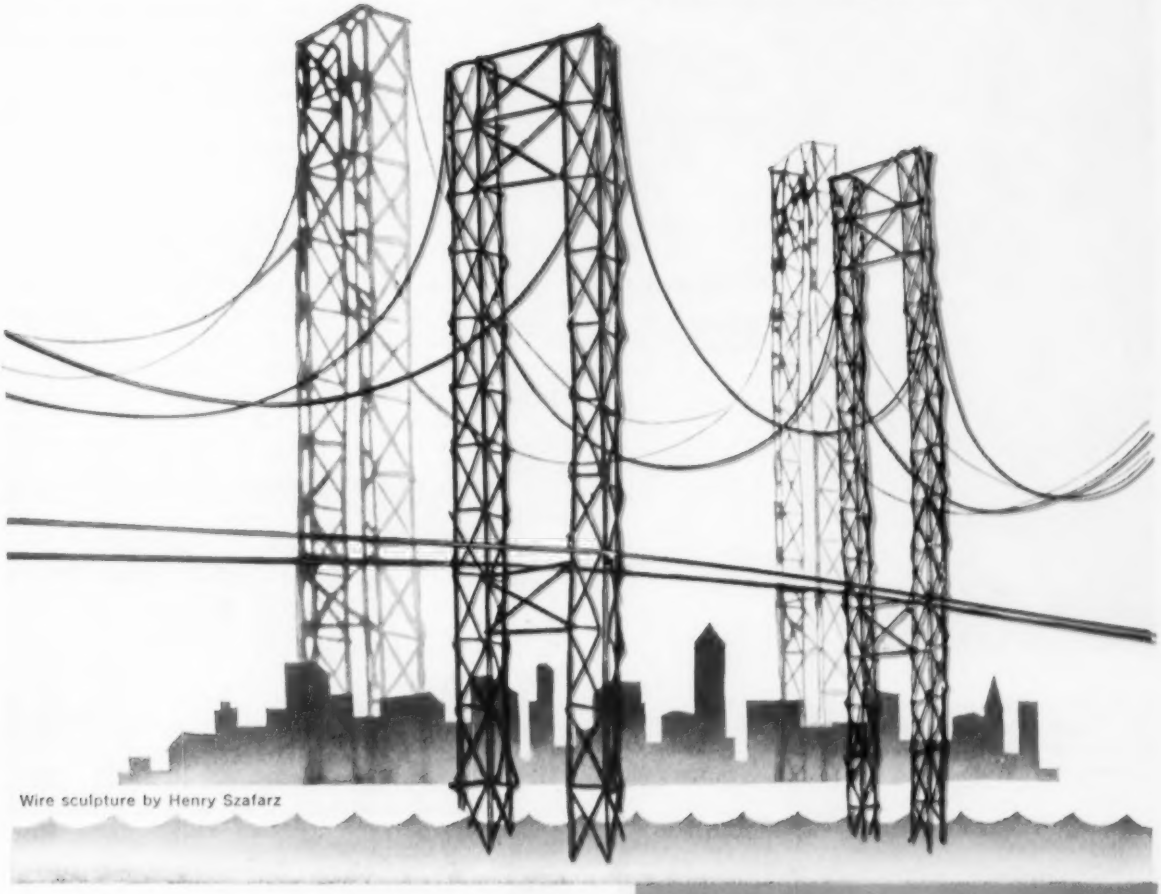
High Voltage Cable Terminating, Sectionalizing, Protecting, and Connecting Devices

POTHEADS • BOXES • OIL FUSE CUTOUTS • LOAD BREAK OIL SWITCHES • SPLICING KITS

"Monument to Power"

Every engineered structure stands as a tribute to the men who planned and built it. And to the efficiency of their equipment, too.
Simplex-ANHYDREX cables, for instance, which are used everywhere for power distribution, control, floodlighting and numerous other functions. These expertly-engineered cables are equally suitable for overhead or in-the-ground use. They resist sunlight, ground acids, alkalies, oil, heat and flame, and their ANHYDREX insulation makes them super-resistant to water.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

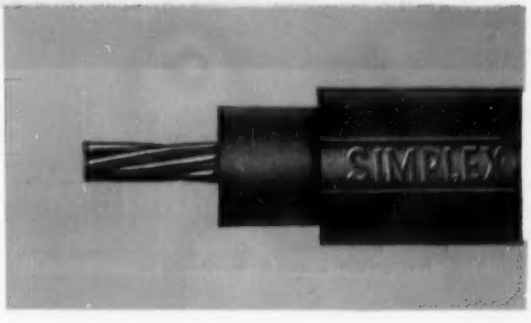


Wire sculpture by Henry Szafarz

Simplex

LIVE BETTER ELECTRICALLY

ANHYDREX



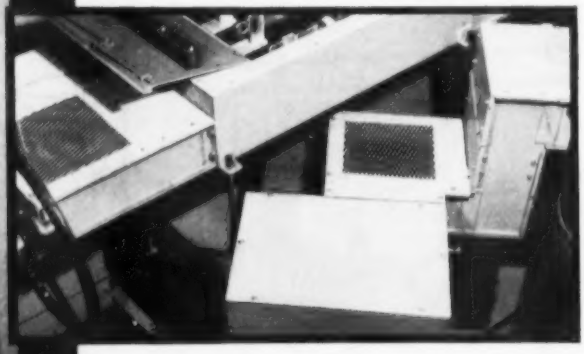
Air conditioning ups power needs of Empire State Building; Aluminum busways provide low-cost solution

Dual-service aluminum busways, each 4,000 amp, connecting utility service with the service switch cubicle.

With increasing frequency, unforeseen air-conditioning loads are making present electrical systems inadequate. The world's tallest building has just solved this problem by installing a 4,000-ampere, 3-phase, 4-conductor, 265/460-volt busway system and a 4,000-amp, 3-phase, 3-conductor, 460-volt busway system using low-cost Alcoa® Aluminum Conductor.

In jobs of this magnitude, aluminum busways provide enormous savings: up to 25% on cost; up to 70% in weight; up to 20% on labor. Compared to cable and conduit, they provide far more flexibility.

When *you* need a modern, flexible, economical electrical distribution system, specify busways made with Alcoa Aluminum . . . and *save*. All major manufacturers of busway systems offer units made with low-cost, high-conductance Alcoa Aluminum. Aluminum Company of America, 2302-G Alcoa Building, Pittsburgh 19, Pennsylvania.



On the top is the 4,000-amp busway with 800-amp fusible take-offs. Underneath is the 800-amp busway system. All equipment by Metropolitan Electric Manufacturing Company.

Consulting Engineers:
The Firm of Edward E. Ashley

Electrical Contractor:
L. K. Comstock & Co., Inc.

Busway Manufacturer:
Metropolitan Electric Manufacturing Co.

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ELECTRICAL CONDUCTORS AND ACCESSORIES
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Your Guide to the Best in Aluminum Value

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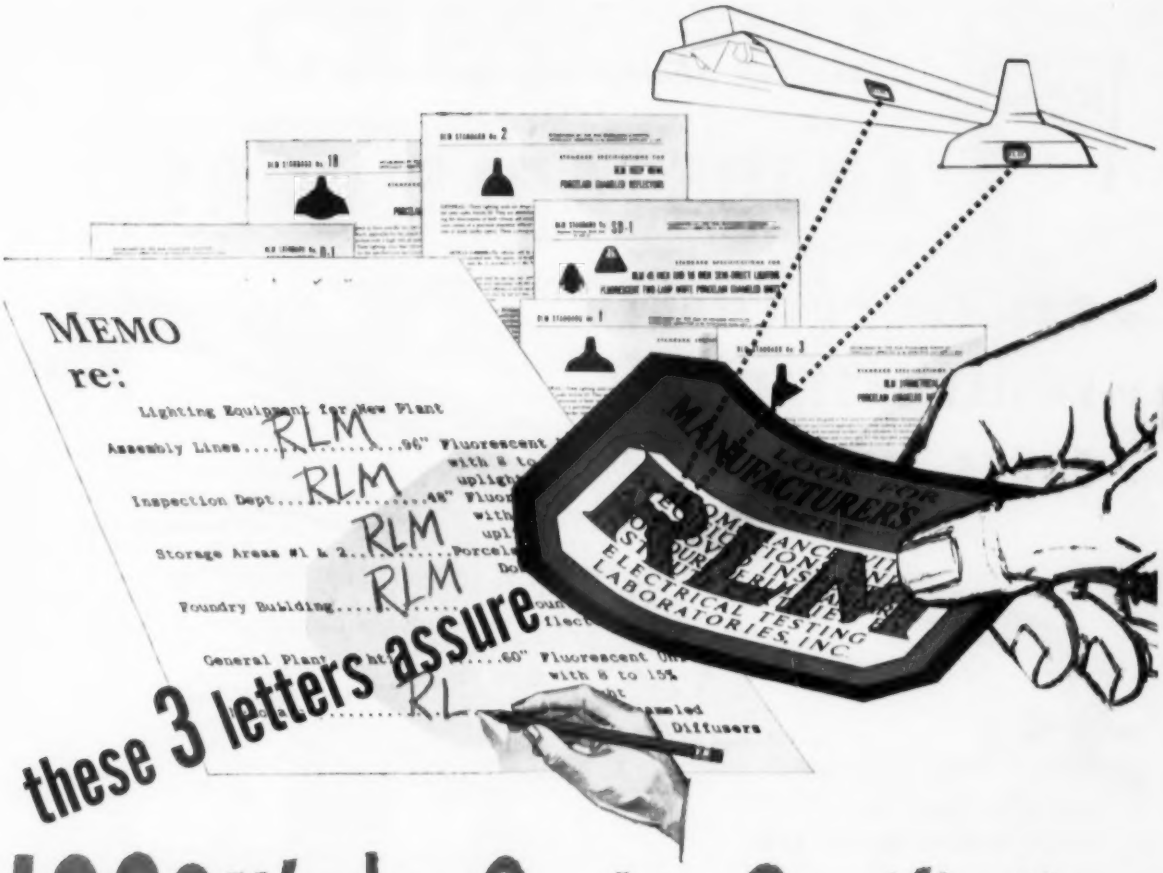

1,000 Words of Quality Specifications

Covering the HIGHEST Industrial LIGHTING STANDARDS in RLM History!

With the addition of just three letters, RLM, you assure lighting units that meet the highest RLM Specifications in history. The many advantages of these specifications are yours on the ten incandescent and fluorescent units most widely used in modern industrial lighting. For each of these ten units, it takes a special RLM Specification of over 1,000 words to cover the minimum RLM quality standards for materials, construction, design, photometric performance, etc.

That is why thousands of electrical contractors, architects, and consulting engineers add the letters RLM to their specifications. They do so, however, with the knowledge that, although each RLM-labeled unit must meet minimum RLM Specifications, each manufacturer is free to incorporate his own special features to give his fixtures further distinctive advantages.

They know, too, that each one of the 1,000 words of RLM quality specifications are also backed by the Institute's Inspection Program. Thru periodic tests by an independent laboratory, this program further assures the buyer that RLM-labeled units will conform constantly and uniformly to every applicable RLM Standard.

Adding the letters RLM is a habit you'll never regret. For the full story behind RLM-labeled lighting units, send for your complimentary copy of the latest RLM Specifications Book. Write: RLM STANDARDS INSTITUTE, Suite 819, 326 W. Madison St., Chicago 6, Ill.

Highest Industrial Lighting Standards in RLM History feature:

Higher light output • Lower-cost installation
Better protection against glare
More seeing comfort • Easier re-lamping
Increased brightness control • Reduction of light loss
Safety from electrical hazards
Protection against rust and corrosion

R-1564

RLM STANDARDS INSTITUTE
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RACO

You Can Always Rely On RACO

ADJUSTABLE BARS

✓ **QUICKLY POSITIONED**

✓ **EASILY INSTALLED**

✓ **SAVES TIME**

NEW STOP-LOCK

Prevents bar from slipping apart accidentally. Permits separation of bar if desired.

SELF-GAUGING

SHALLOW OFFSET

Place gauging lug against edge of rafter or joist and nail in place.

DEEP OFFSET

Straighten gauging lug and line up flush with edge of rafter or joist.

SERRATED NAILS ARE PRE-ASSEMBLED TO THE BAR

Ready for immediate installation.
No hunting for nails.

✓ **EXTRA STRONG**

THE ONLY BAR ON THE MARKET WITH RIGID "M"" CONSTRUCTION

RACO Adjustable Bars have been vastly improved. Note these extra advantages . . . pre-assembled serrated nails for easy installing . . . self-gauging lugs for fast positioning . . . friction stop-lock that prevents bars from accidentally slipping apart. High quality electro-galvanized finish. Write today for new bulletin describing these superior Raco Adjustable Bars.

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Simplifies stock control . . . requires less investment in inventory. Two sizes fit most every job.

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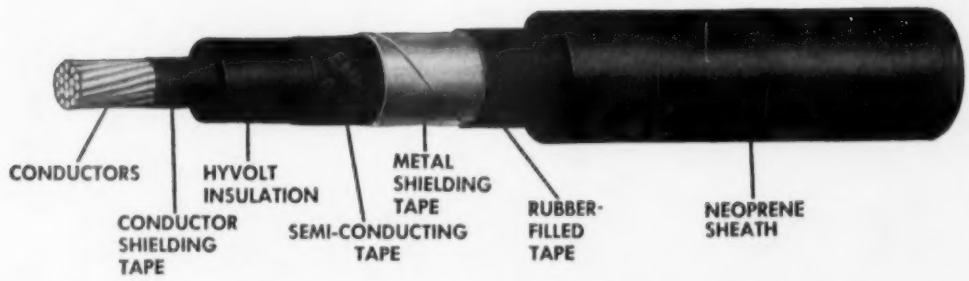
ALL-STEEL EQUIPMENT INC. Aurora, Illinois

CRESCENT

OVER 70 YEARS EXPERIENCE

HYVOLT SHIELDED POWER CABLE



For More Amperes Per Dollar of Installed Cost

ADVANTAGES

1. Long life
2. Can be operated at 85°C. Permits smaller conductors or more amperes per conductor.
3. Freedom from corona cutting
4. Excellent resistance to moisture
5. Low power factor and dielectric loss
6. Lighter, more flexible, easier to handle and install than lead covered cables
7. Electrolytic or chemical corrosion of lead sheath is eliminated by use of neoprene sheath
8. Shielding prevents possibility of surface burning and provides safety to human life.

CRESCENT HYVOLT insulation is made from butyl rubber which is inherently resistant to ozone, heat, moisture and aging. HYVOLT is formulated and processed so as to retain these inherent characteristics of the butyl rubber and at the same time provide excellent electrical and physical properties.

The insulation is protected during and after installation by an outer neoprene sheath providing a maximum degree of toughness, durability and long life. It is flame retarding and resistant to the deteriorating effects of moisture, sunlight, ozone (corona), oil, grease, and many acids and alkalies.

HYVOLT Shielding provides additional internal and external protection in these THREE WAYS

1. Conductor shielding, as provided by a semi-conducting tape over the stranded conductors, excludes air pockets between conductor and insulation and eliminates possible internal corona-cutting of the insulation.
2. The semi-conducting tape between the insulation and metallic shielding tape prevents possible ionization of air spaces and corona at the insulation surface.
3. The metallic shielding tape is grounded when installed, resulting in zero potential to ground at the sheath. It prevents surface discharge or burning, and protects cable from lightning surges. Reduces shock hazard.

RECOMMENDATIONS

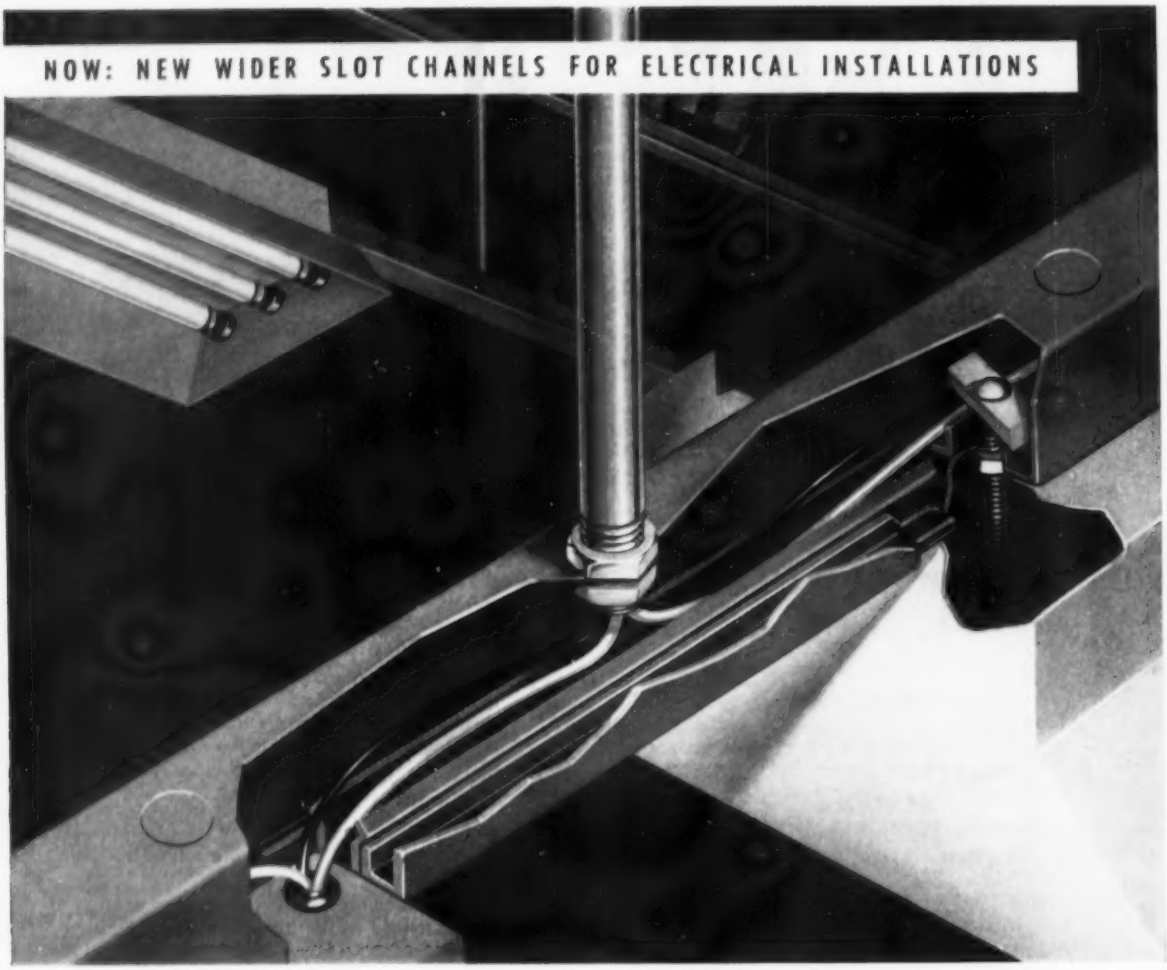
CRESCENT SHIELDED HYVOLT CABLE is recommended for use in conduits, underground ducts, in wet or dry locations, or buried directly in the ground, for circuits operated at over 3000 volts and in accordance with I.P.C.E.A. recommendations. Available in single conductor or multi-conductor cables.

Specify CRESCENT SHIELDED HYVOLT POWER CABLE for general power circuits and where severe conditions are prevalent such as chemical plants, refineries, paper mills, mines, sewage disposal plants, etc. It is approved as Airport Lighting Cable Type B, CAA Specification L-824.

CRESCENT INSULATED WIRE & CABLE CO.

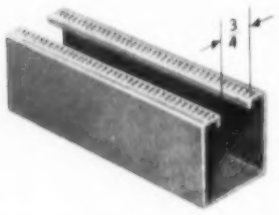
TRENTON 5, N. J.

NOW: NEW WIDER SLOT CHANNELS FOR ELECTRICAL INSTALLATIONS

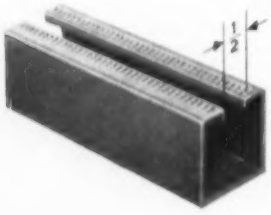


Install Fluorescent Fixtures — Without Special Tools

Mult-A-Frame It!



Now for your convenience—new channel, #7121 and #8161, above, have wider ¾" slot for easy access. Standard channel, #5121 and #6161, below, have ½" slot.



Introducing: in addition to the four existing channels you have been using, two new MULT-A-FRAME channels, designed to speed electrical installations. Convenient wider slot now allows easy access.

Available in 12- or 16-gage (channel #'s 7121 or 8161) steel for greatest span flexiblity, these new channels are ideal for fluorescent fixture supports and other electrical installations. Dimensions 1⅝" square with wide ¾" slot.

Only tools needed to MULT-A-FRAME are a saw and pair of ordinary pliers. You get safe and sturdy fixture suspension while keeping on-the-job labor costs rock-bottom.

For complete information on the cost-less features of MULT-A-FRAME, send for your free copy of the new MULT-A-FRAME catalog—or, if you prefer, contact your local distributor direct.

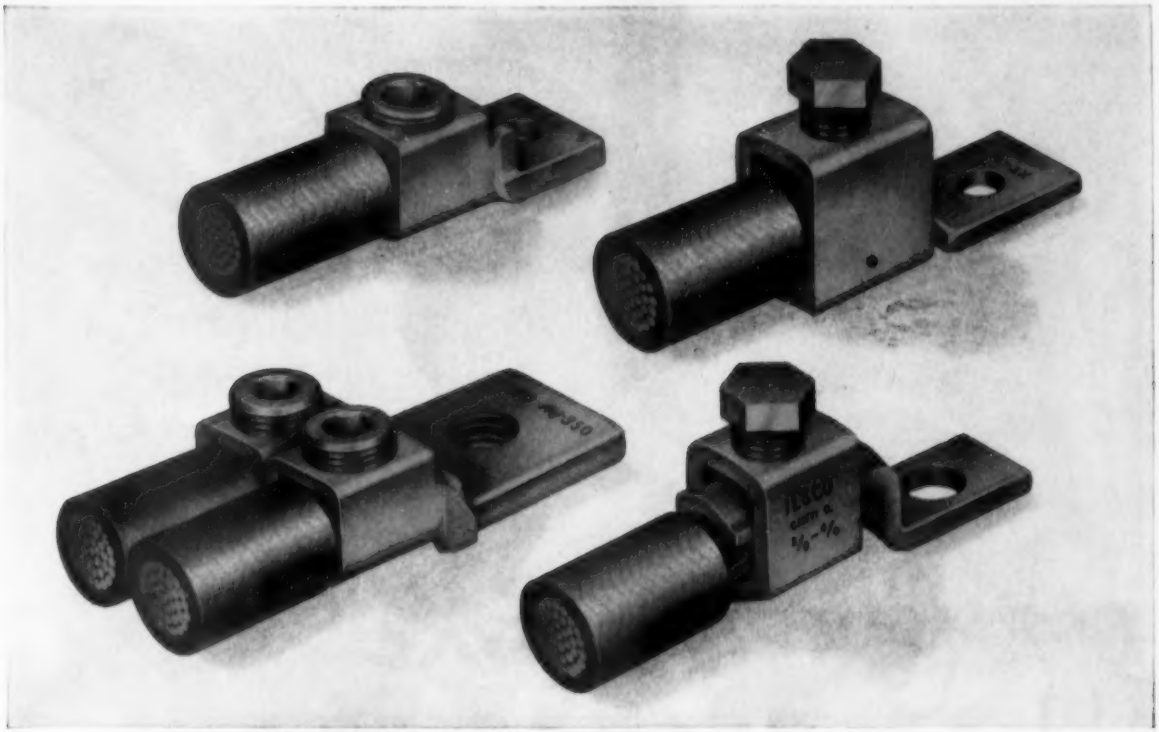
MULT-A-FRAME
AINSWORTH DETROIT U.S.A.

E-4

MULT-A-FRAME DIVISION

Ainsworth Manufacturing Corporation—1471 E. Atwater Street, Detroit 7, Mich.

eliminate POWER PILFERAGE



with connectors made the ILSCO way

Everyday, more and more electrical designers and engineers specify and recommend the purchase of Ilsco connectors because they know they get these important added benefits:

100% pure electrolytic seamless copper gives Ilsco connectors 100% conductivity. The copper is cold-worked to preserve its natural properties.

Compact, light-weight Ilsco connectors possess strength, secureness and capacity *equal to or greater than* much heavier and larger cast alloy types. You save space, handling trouble and money.

Ilsco connectors do not overheat. Under normal conditions, operating temperatures remain as much as 50% below permissible UL maximums. That means greater safety, fewer trouble spots in your layout.

Join the ranks of Ilsco's satisfied customers. Find out how much time, trouble, worry and hard cash you can save.

Write for your free copy of Catalog # 50 and samples. Dept. C-7.

CONNECTORS • FABRICATED TUBES • NEUTRAL BARS
SOLDERING LUGS • STAMPINGS • TERMINAL BLOCKS
SHADING COILS • WIRE-REINFORCED FUSE CLIPS

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4730 Madison Road • Cincinnati 27, Ohio

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There's a
BULL DOG TAPE
for every purpose

- **FRICTION**
- **RUBBER**
- **PLASTIC**

BULL DOG TAPE is a man's best friend! Delivers thoroughbred performance every time. It goes on fast . . . sticks tight and stays tight. Splices neatly . . . extra strong and non-ravelling. High dielectric strength for complete all-around electrical protection. BULL DOG is *tough*, too . . . resists weather and moisture . . . stands up longer on the job!

Sold only through verified wholesalers

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BOSTON *BOSTON WOVEN HOSE & RUBBER COMPANY*
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Pennsylvania's Turnpike... Model for Modern Motoring

WIRE BY PHELPS DODGE

When the Pennsylvania Turnpike opened in 1940, it was the first modern highway of its kind in the East. Since then, it has earned a reputation as a model super-highway whose design combines a free flow of traffic with a low accident rate.

One of the requirements for the Turnpike tunnels, interchanges, approaches and portal buildings was an electrical system of the highest quality. That's why Phelps Dodge building wire and rubber insulated, neoprene-jacketed cable was installed. For 17 years, this wire and cable has been giving the Turnpike dependable, trouble-free service.

On every wiring job where top-quality performance, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge distributor!*

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Write for a better way to make your profits go up

Advance information about new projects makes the difference between boom and bust when you do business with the construction industry. Dodge Reports not only give you early notice—they help you follow through by telling you whom to contact and when the job is out for bids (even who's bidding) on just the kind of work you want. If you'd like to know how to pin-point the "live" prospects that will help make your profits rise, just read and mail this coupon today.

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I want to know whom to contact and when to submit bids.

I'd like to see some Dodge Reports, and I'd like a copy of your booklet that tells how to use this accurate, daily, up-to-the-minute construction news service.

I understand that I can pick just the area in the 37 Eastern States and the type of construction activity that interests me. Also, that I won't have to wade through mounds of data to find the information I need.

I'm interested in General Building ☐ **House Construction** ☐ **Engineering (Heavy Construction)** ☐

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For Timed Selling to the Construction Industry

Specify PYLE-NATIONAL COUPLINGS for flexible electrical connections...

More and more engineers and maintenance men are analyzing the environment in which electrical equipment must operate before determining the type and make of couplings that are required to do the best job. And more and more they're specifying Pyle-National!

Whether for a simple multi-conductor flexible cord connection, an installation in a hazardous area or a constantly flexing conduit in a severe oil bath environment such as the one pictured above —there is a Pyle-National coupling for every application!

New HKU Union Couplings for reinforced, oil-resistant rubber conduit. Grip cannot loosen—super-tight, super-durable under any amount of continuous flexing.

CT Couplings for liquid-tight flexible conduit

PYLE-O-FLEX® for hazardous locations. Explosion proof —dust-tight—submersible

DB Sealing Grip Couplings for flexible cords and cables

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Silicone Insulation Offers New Economy For Outdoor Motors

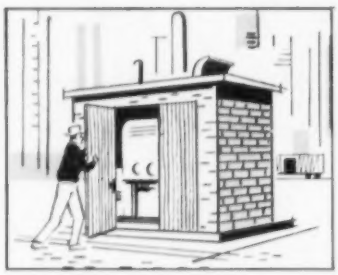
Silicone insulation is establishing a trend towards less costly enclosures for outdoor motors. By readily withstanding moisture and contaminants circulated in ambient air, silicone insulation makes possible more open enclosures and lower motor cost per horsepower.

Several leading electrical equipment manufacturers now offer a line of silicone-insulated "all-weather" motors in most large horsepower ratings.

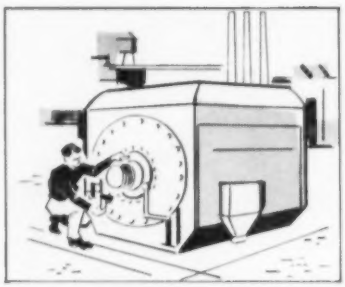
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone-insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, wind-driven dust, snow, sleet, cold and heat.

Long insulation life is assured by the water-repellent silicone-insulated windings that survive even flooding. Silicone insulation on motors, generators and transformers provides up to 50% greater service factor for absorbing overloads, adds immeasurably to reliable operation and increases insulation life 10 times or more. That's why it's wise to—

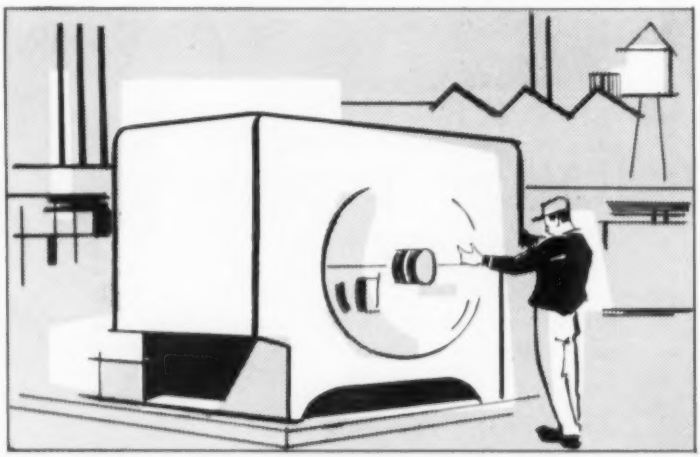
SPECIFY DOW CORNING SILICONES
and Save



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere



Now, silicones protect motor parts permitting the circulation of ambient air and lower-cost enclosures.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

Atlanta • Boston • Chicago • Cleveland • Dallas • Detroit • Los Angeles • New York • Washington, D. C.

US RUBBER ROYALASTIC TAPE

For a safe job . . . use Royalastic plastic tape

This is the plastic tape that's designed for a wide range of foolproof jobs. Royalastic does the work of both rubber and friction tape. It gives complete mechanical and electrical protection, and is highly resistant to water, oils, acids, alkalies and corrosive chemicals. High dielectric strength and high tensile strength. Good stretch. Makes thin splices, clings tightly, keeps wiring neat and uncluttered. Approved by Underwriters' Laboratories, Inc.

You can get fast delivery of Royalastic at any time. Get in touch with any of our selected distributors, or any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

In Canada, Dominion Rubber Co., Ltd.

US RUBBER

Mechanical Goods Division

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SEE THINGS YOU NEVER SAW BEFORE. VISIT U.S. RUBBER'S NEW EXHIBIT HALL, ROCKEFELLER CENTER, N.Y.

BE MODERN,

increase protection, buy Westinghouse

there was a time when a boxful of spaghetti wiring and a jumble of literally "shocking" fuse blocks was called a panelboard. Few folks still think there's a reason for such equipment.

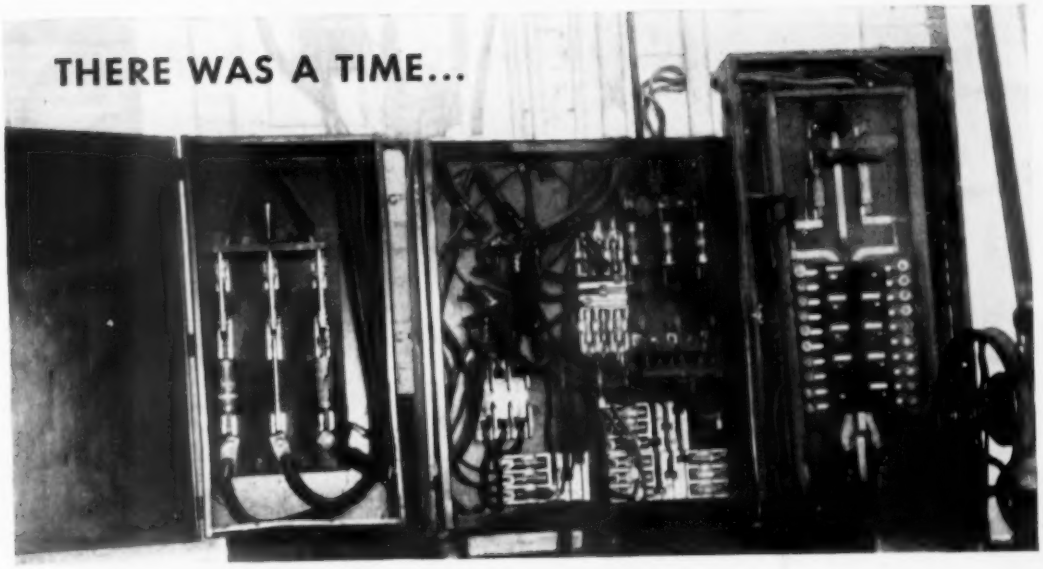
now, any distribution system involving the safety and continued productivity of people and plants calls for modern engineered panelboards and switchboards. A typical Westinghouse combination is shown at lower right... but there are ever so many other types, designed for everyone's needs. All are factory assembled—easy to install, convertible to infinite circuit combinations.

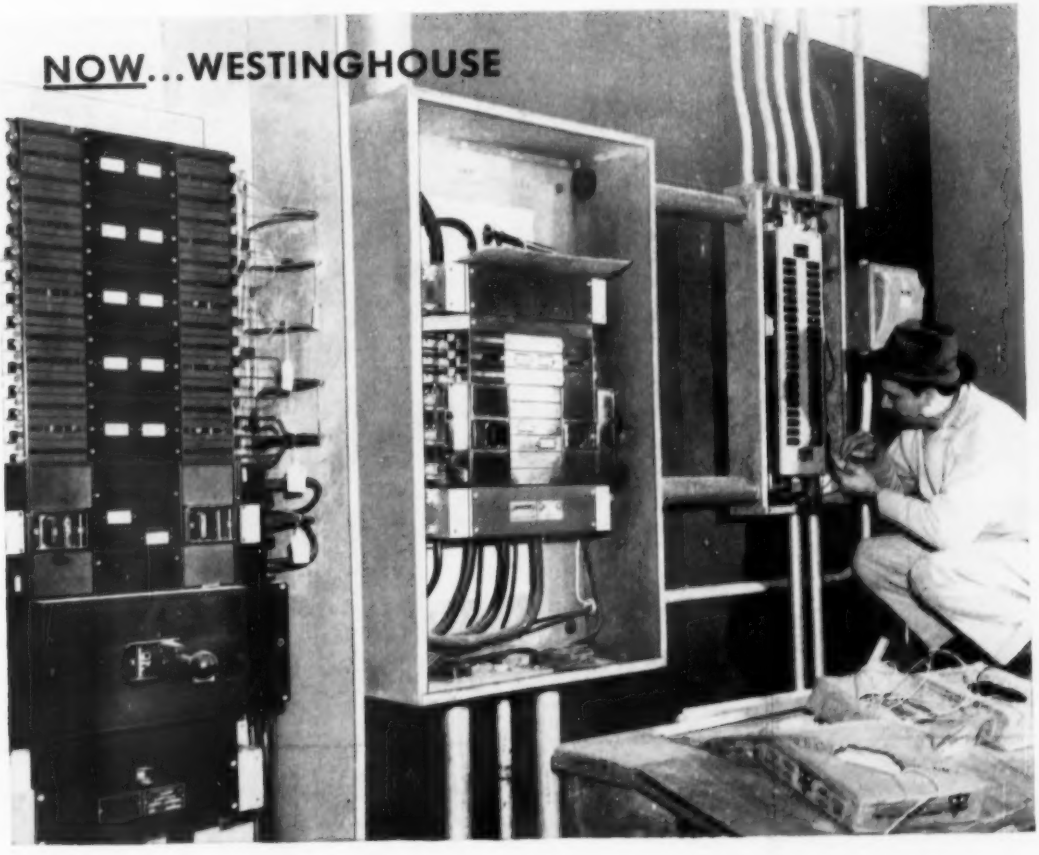
J-93535

this book tells how to select the right panelboards to fit varying distribution problems. Write for your copy today. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE **SURE**...IF IT'S

Westinghouse


THERE WAS A TIME...

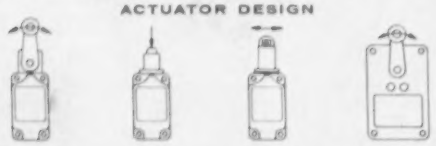

NOW...WESTINGHOUSE

MICRO SWITCH . . . FIRST IN PRECISION SWITCHING

These low-cost MICRO SWITCH controls increase production speed and efficiency—reduce breakage, waste and injury

TYPE LS SERIES—Rugged, small, reliable. Moving parts and switching chamber completely sealed. Two-circuit, double break contact arrangement. Operating force—3 lbs. max. No. 8 terminal screws accommodate No. 14 stranded wire.

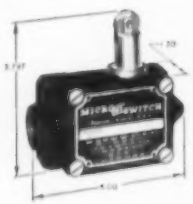
ACTUATOR DESIGN



TYPE ML SERIES—Heavy duty limit switches. Combine rugged, sealed construction, precise operation and extremely versatile adjustability. Available in high-capacity, explosion-proof and two-circuit versions.

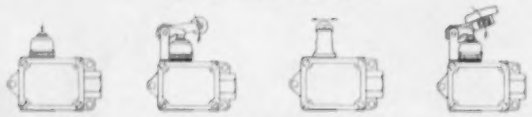
ACTUATOR DESIGN

Thousands of plant operating men are using these versatile switches to upgrade present plant equipment

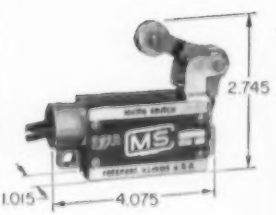


TYPE F SERIES—Rugged, compact precision switches with high current capacity. Seals make enclosure dust and oil-tight. Accurate repeatability. Available in either left hand or right hand designs. The SPDT series will make and break steady state currents of 20 amps. 125, 250 or 460 vac and handle in-rush currents as high as 75 amps.

ACTUATOR DESIGNS

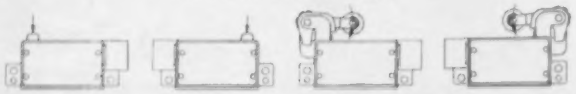


For complete information Send for Catalog 83



TYPE LN SERIES—High strength cast enclosure and design of plunger mechanism permit rapid, hammer-blow cam actuation without harm to enclosed basic switch. Extremely compact design often permits use in applications where no other switch will fit.

ACTUATOR DESIGNS



MICRO SWITCH precision switches for plant equipment are available in hundreds of variations of actuator designs, circuitry, electrical capacity and terminal designs. See your nearby Authorized Distributor. Look under "Switches, Electric" in the Yellow Pages.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

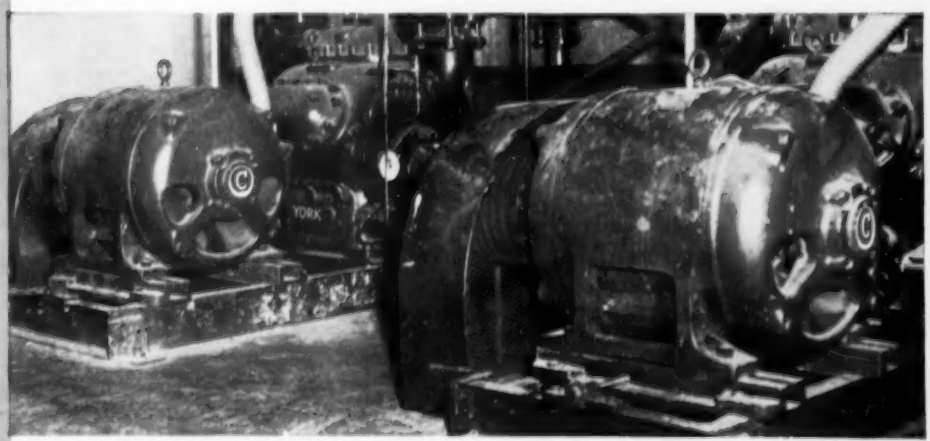
In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

Special low-current starting costs less WHEN YOU SPECIFY

Century PART WINDING START MOTORS

Here's the easy and inexpensive answer to having big motors that will start easily when starting current is limited. Part winding starting is available on all popular size Century motors up to 400 H.P., polyphase, in drip proof, totally enclosed and explosion proof frames, horizontal or vertical mounting.

For fast service from stock, call your nearby Century Distributor or Century District Sales Office.



Two 50 H.P. Century Part Winding Start motors power these unloading type air conditioning compressors. When starting, just half of the winding is energzied, drawing less than two-thirds of normal starting current. In a few seconds, the full winding is connected and the motor delivers full torque at full current.

Get your free copy of our bulletin: "Where Low Starting Current is Required." Mail this coupon today . . .

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Please send copy of bulletin "Where Low Starting Current Is Required"

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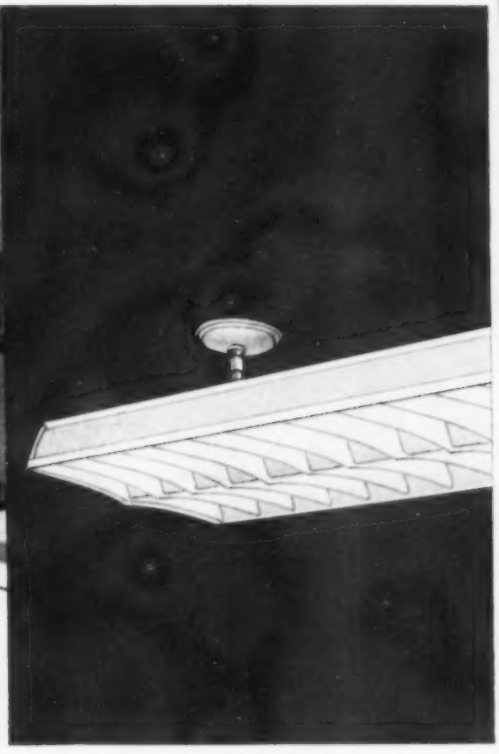


DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

Electrical contractors Cal Gilbert and Harry Becker of Gilbert & Stearns, Santa Ana, California

"True alignment . . . greater savings"

For over 30 years we've been looking for ways to do jobs better with simpler and less expensive methods. It wasn't until our first Day-Brite job that we really had something to talk about.

"Day-Brite 'A-J' hangers showed us how much time we could actually save on installation. Fixture runs of more than 200 feet finished out with true alignment and considerable savings on labor.

"Day-Brite packing is so complete that extra on-the-job assembly is eliminated. The excellent finish on Day-Brite fixtures reduces to a minimum the scratches, chipping and peeling we usually experience with other units.

"Yes, we're great Day-Brite boosters. On every lighting job we engineer, these are the fixtures we specify and use!"

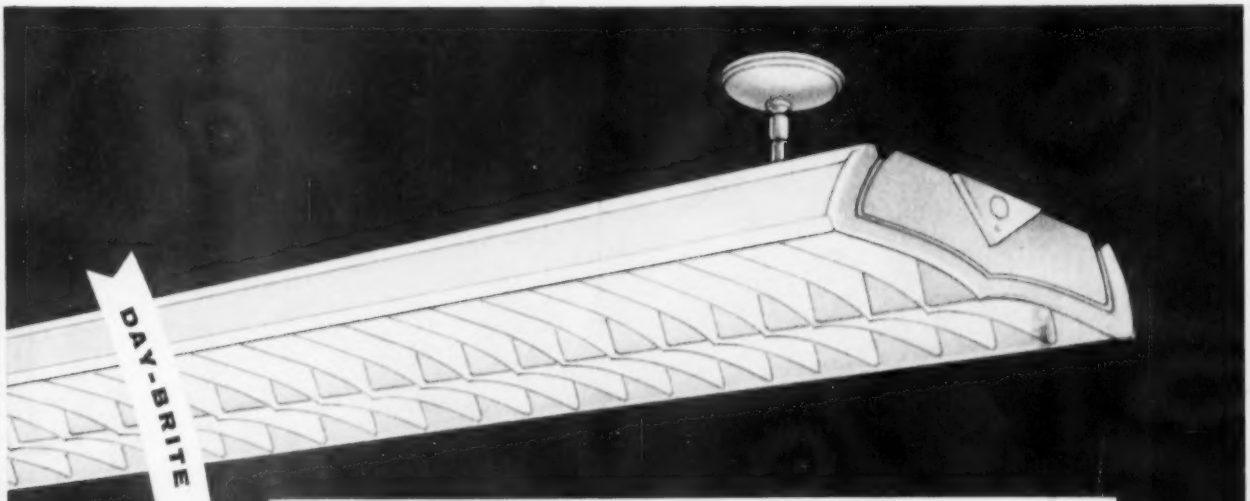
It's hard to top enthusiasm like Mr. Becker's! Like to feel that way about a fixture, yourself? Specify Day-Brite and see.

Certified Lighting for a Better America

DAY-BRITE LIGHTING, INC., *5402 Bulwer Ave., St. Louis 7, Mo.*
Day-Brite Lighting, Inc., of Calif., 530 Martin Ave., Santa Clara, Calif.

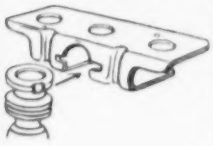
71117

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

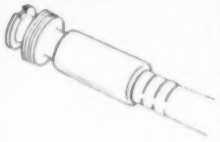


DAY-BRITE ON THE JOB MAKES THE BIG DIFFERENCE HERE

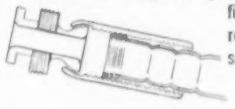
Fits anywhere, fast... Ceiling mounting bracket can be mounted to ears of outlet box, fixture stud or direct to ceiling. Slotted arrangement accepts top swivel fitting to hanger stem. No locknuts required.



Easy to level... Hand-operated adjustment can be made after installation is completed. Provides for one inch of vertical adjustment to allow lining up fixture runs.

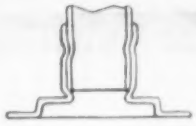


Uneven ceilings no problem... Swivel-top fitting allows up to 15° realignment to compensate for uneven ceilings.

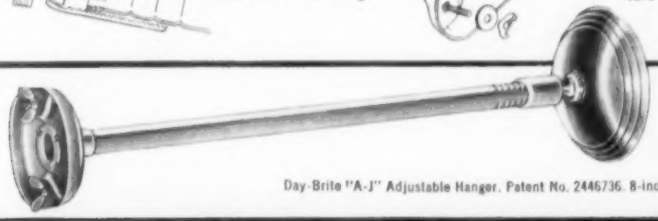


No setscrews in ceiling canopy... Self-centering is assured through offset knurled canopy ring; cannot go off-center.

No locknuts required... Bottom stem fitting machine-crimped to stem. Offset design assures easy locating and positive self-centering into bottom canopy.



No tools needed... Wing nuts provided for easy attachment of fixture to hanger. Used at ends and coupling points of fixture runs.



Day-Brite "A-J" Adjustable Hanger. Patent No. 2446736. 8-inch, 12-inch, 24-inch.

WEEKLY TIME CARD

Name John Smith

Time Card for Week Ending July, 12 1957

Job No. 125 Job Description Third National Bank

HOURS		MON	TUE	WED	THU	FRI	SAT	SUN	
From	To								

Why *more* electrical contractors are buying *more* control equipment from CLARK distributors

Clark Control Specialist (center) assists distributor salesman in solving electrical contractor's problem.

You have a CONTROL SPECIALIST at your service when you deal with CLARK distributors

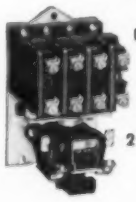
Your electrical control installations will be the best engineered and most dependable in operation if you deal with a Clark distributor. Why? Because when you buy Clark products, you have a factory-trained Clark representative—a control specialist—available for help in selecting and applying the proper controls for any job—large or small. Besides giving you the benefit of his own experience and "know-how" he can call on the extensive application engineering staff at the Clark home office for solving unusually difficult or complicated problems.

But that's not all! Clark's reputation for quality and dependability is unsurpassed in the control field. For example: The Clark Type "CY", with its exclusive and revolutionary arc-quenching principle is the outstanding AC magnetic motor starter. Type "PM" Relays, with sectional pole construction, are setting new standards for 10-ampere, heavy duty relays in small space. Type "DM" Limit Switches, with nylon rollers and latch parts are tops in dependability and long life. New Bulletin 141 Reversing Drum Switches offer many advantages in the control of small motors and include a type with "Instant Reversing"—another Clark exclusive. The Clark-American line gives you a full range of Service Entrance Equipment—up to 200 ampere capacities.

◂ CLARK TYPE "CY" STARTERS SIZE 0-4

CLARK ▸ TYPE "DM" LIMIT SWITCHES

CLARK ▸ BULLETIN 141 REVERSING DRUM SWITCHES



◂ CLARK TYPE "PM" RELAYS 2 TO 12 POLES

CLARK-AMERICAN ▸ SERVICE ENTRANCE EQUIPMENT

For more information contact your Clark distributor or one of the Clark sales offices located in principal cities throughout the country.

The **CLARK** **CONTROLLER** *Company*

Everything Under Control

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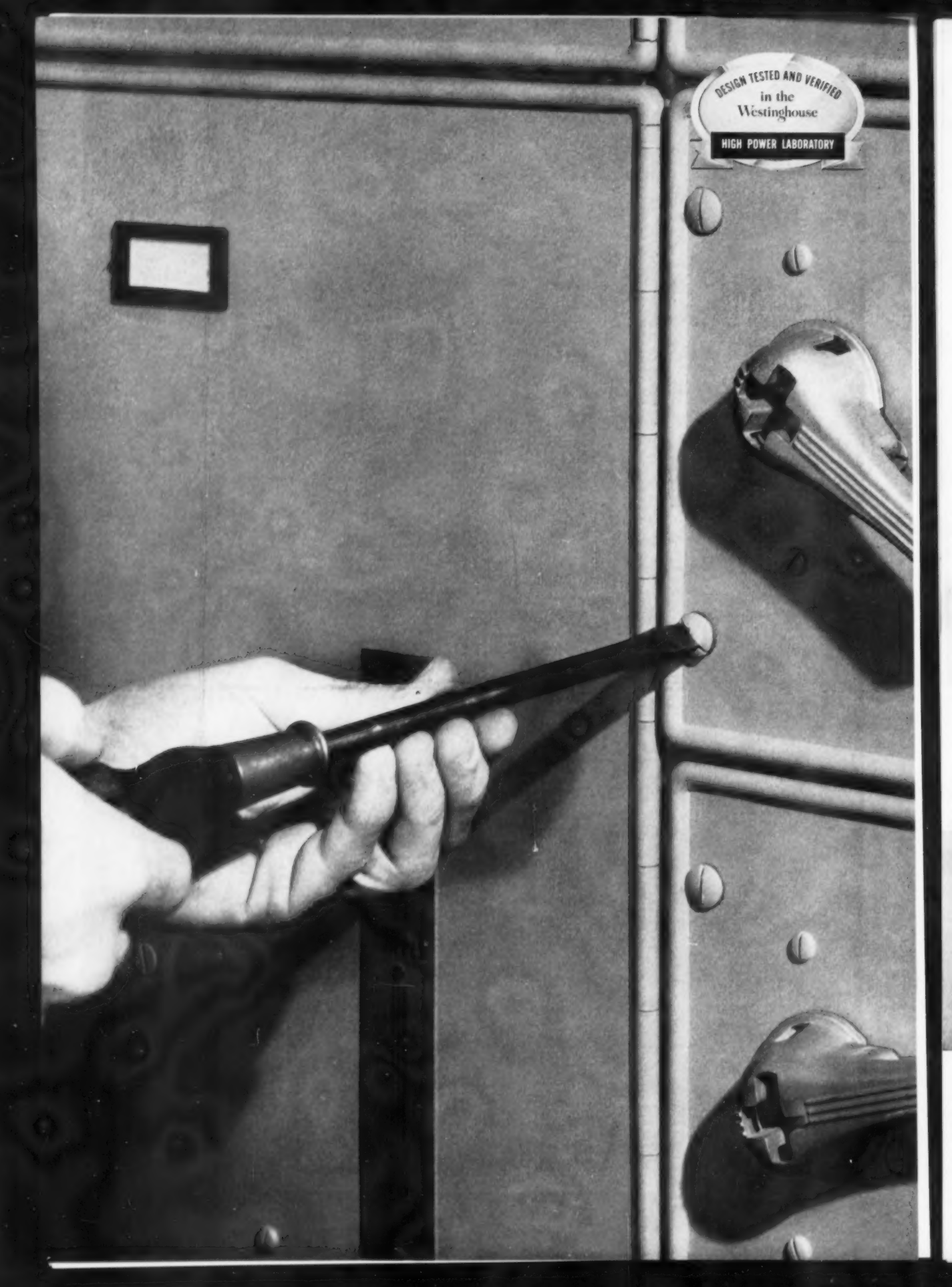
running into low ceilings?
get new GUTH SLIMLUX...only 4¼ inches deep!
Low modern ceilings call for slender surface-mounted fixtures, and Guth answers the call with ceiling-hugging SLIMLUX.
SLIMLUX operates cooler, too. It's built extra-rugged—with high-quality ballasts—to maintain 90° (or lower) operating temperature and give top ballast performance. Be sure that the surface fixture you specify is heat-tested!
SLIMLUX OFFERS A HUGE VARIETY OF MODELS
... for every application. Here are some of your choices:
2-light or 4-light widths
4-foot or 8-foot lengths
Sides: L. W. with Light Windows, or S. S. with Solid Sides
GrateLite louver diffuser; metal cross baffles, or Pattern #70 low brightness lens.
WRITE TODAY FOR ALL DETAILS
U. S. Pat. No. 2,745,001
Canadian Patent 1957, No. 538,245
THE EDWIN F. GUTH COMPANY
Guth
TRUSTED NAME IN LIGHTING SINCE 1902
ST. LOUIS 3, MO.


DESIGN TESTED AND VERIFIED
in the
Westinghouse
HIGH POWER LABORATORY

Now Westinghouse announces complete control center flexibility

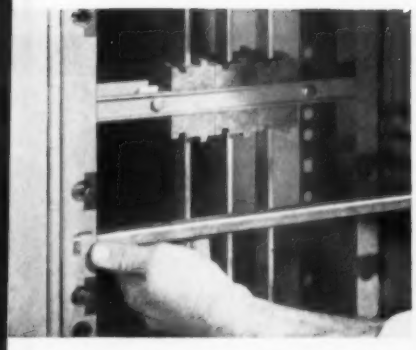
New design meets changing requirements with both 14- and 9⅓-inch modular units

From the new 9⅓-inch units to the dependable electrical components, the new Westinghouse control center is designed to meet your present requirements and future needs. Both the 14-inch and 9⅓-inch units can be quickly interchanged within a standard structure.

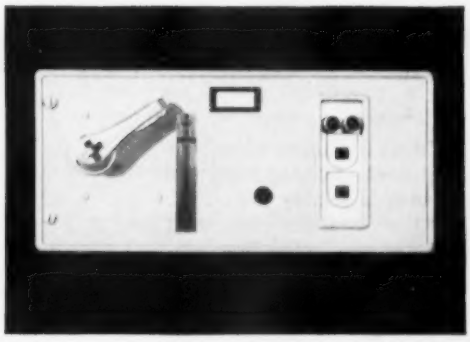
Fully interchangeable with the old design, this new control center is available for front mounting or back-to-back mounting . . . in same structure with common vertical bus. Everything about this new Westinghouse unit says good design, safety, and versatility. And you have the advantage of dealing with one source to supply all components. Call your Westinghouse sales engineer for all the facts. Or, write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. Ask for B-6722. J-21941

YOU CAN BE **SURE**... IF IT'S

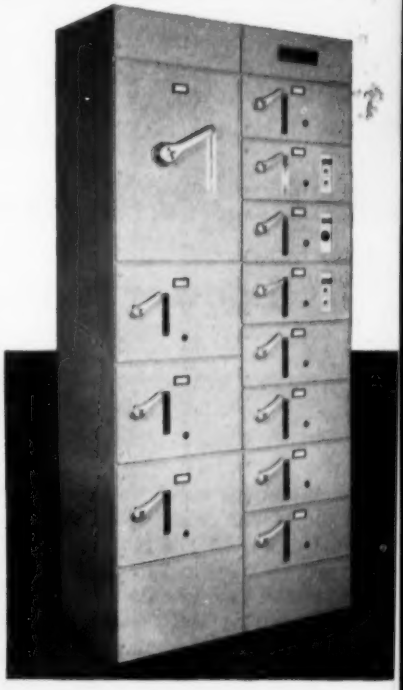
Westinghouse



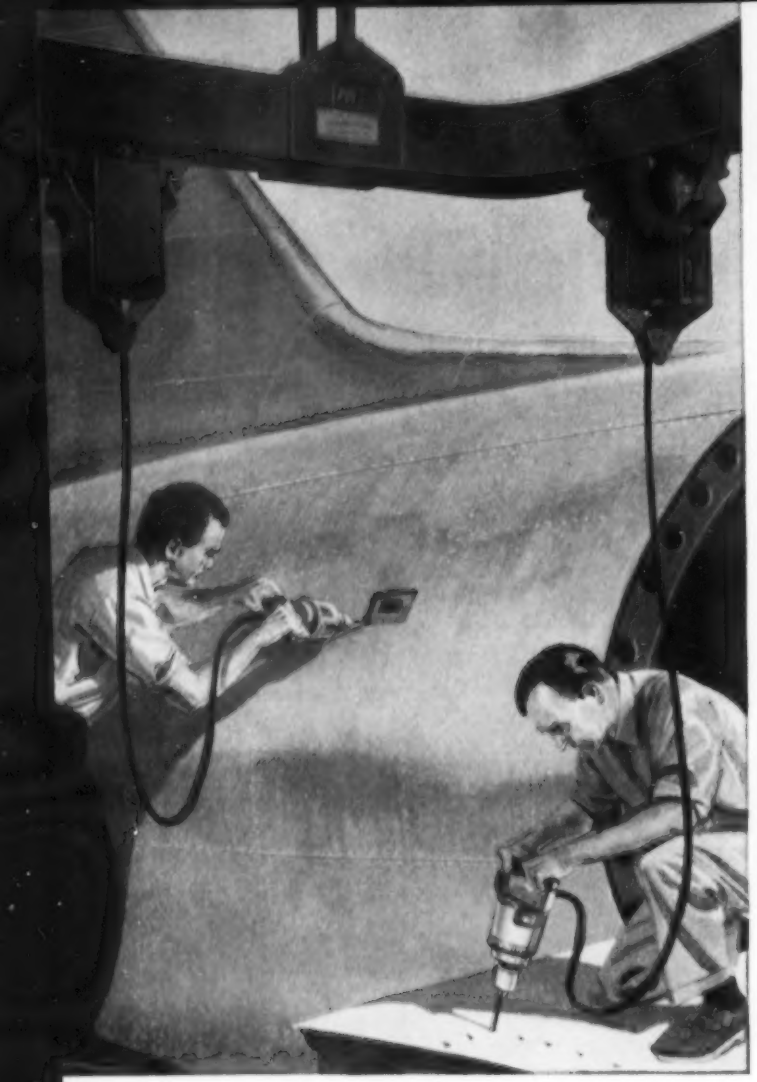
Slight Movement of Retaining Clips . . . and horizontal starter unit support bar can be moved to any position for interchangeability of 9⅓- or 14-inch Westinghouse modular units.



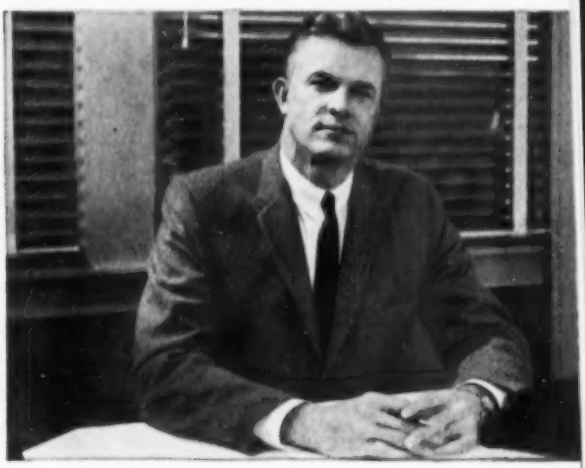
Door Cutout makes it unnecessary to change door when changing pilot device arrangement. Quick-make, quick-break, positive-action, modern pushbuttons in strong molded case take up less space.



Here Is Complete Flexibility . . . of structural units and electrical components. Each vertical structure holds from one to eight, front only, or up to 16 back-to-back units, to meet all needs.



Smooth-rolling trolleys tap power from the duct . . . can be added, removed or relocated in minutes without any downtime or rewiring. Duct is rated at 100 and 225 amps. Special curved sections can be ordered to fit any production line.



Your BullDog field engineer will be pleased to give you all the details on Industrial Trol-E-Duct and other BullDog products. Call him. You'll find his know-how very helpful in planning new systems or modernizing existing systems.

Roll power to the job—earn repeat business, more profits!

When you install an electrical system does it actually contribute to higher production? Here's one that does—BullDog Industrial Trol-E-Duct®! It puts *mobile* power over assembly lines . . . offers electrical flexibility that saves time and increases plant output. And when a customer needs to add new production units, he merely inserts a new trolley . . . *without downtime or rewiring.*

Industrial Trol-E-Duct is but one of many BullDog electrical distribution products which help you plan better power systems . . . add lustre to your reputation. From safety switches to Unit Substations, BullDog equipment consistently turns in the safe, efficient, production-boosting performance that earns new business . . . more profits . . . for you.

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BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada), Limited, 80 Clayson Rd., Toronto 15, Ontario

IF IT'S NEW... IF IT'S DIFFERENT... IF IT'S BETTER... IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

ELECTRICAL CONSTRUCTION AND MAINTENANCE

56th Year — JULY • 1957

Highway Lighting — A Challenge

One of the most challenging opportunities of recent times for the electrical industry is presented by the tremendous highway building program now under way and projected about 13 years into the future. The 41,000-mile Interstate system authorized for 90% Federal aid is the greatest road building project of all time.

The importance of lighting in modern highway design is illustrated by one study of 28 locations disclosing that the average fatality rate for the year following lighting was 68% below the year preceding. It hardly needs statistics to confirm the common experience that good fixed roadway illumination is an inherent aid to safety in any area of driver decision.

Present industry objectives as to lighting applications are virtually rock-bottom essentials. They call for modern fixed lighting systems at interchanges, bridges, underpasses, tunnels, entrance and exit ramps, areas of motorist decision, and continuous roadways, in urban areas and between closely spaced interchanges. Such applications are expected to include about 7% of the total Interstate highway mileage and would influence applications to a much higher percentage of connecting roadways.

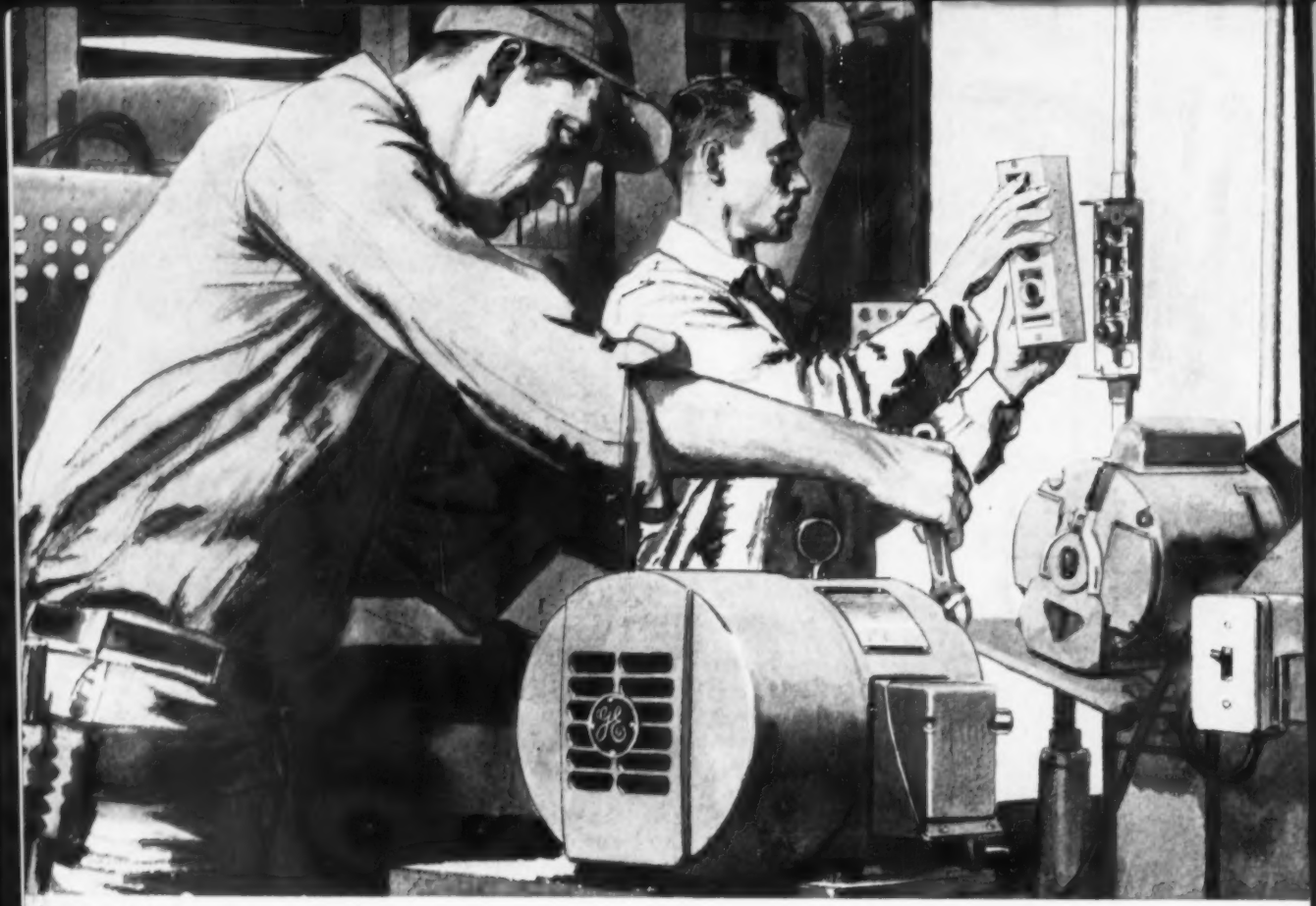
State highway departments will carry the burden of design. They will be faced with an acute shortage of engineering manpower trained in the specialized field of highway lighting application and in the design of supporting electrical systems. They will need expert help from the electrical industry.

It will be up to the highway departments to enlist what technical resources are available in each area in accordance with the particular problems with which they have to cope. But industry people should be prepared to meet the situation with intitiative and understanding.

The task calls for the professional services of consulting electrical engineers, the knowledge and experience of electrical contractors for both installation and maintenance, and the helpful cooperation of adjoining public utilities and municipal electrical departments.

What is done about lighting the Interstate highway system will have a tremendous influence eventually on the whole field of highway and street lighting throughout the United States. And that prospect is of major interest to all of us, the electrical industry and the public alike.

Wm. T. Stuart



Exactly the right G-E motor in type, speed and power for every drive job is ready for you through any Graybar location. Through the same convenient source you, and your customers, can get experienced help in picking the right controls. To insure proper selection, you don't need to know all about all controls. Just know — and use — the phone number of your nearest Graybar office.

How to pick the one best G-E MOTOR and CONTROL for any power drive you may have

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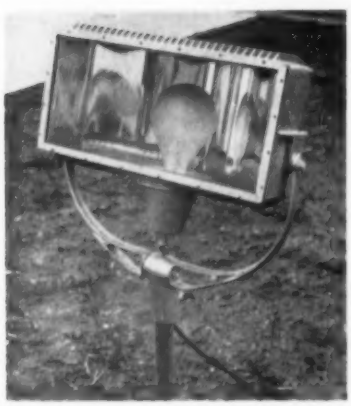
ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Progressive electrical design provides modern industrial plant with . . .

FLEXIBILITY FOR EXPANSION

Relay and contactor control plus local 277-volt switching for extensive 800-milliamp lighting installation, pacesetting mercury floodlighting, plantwide grounding grid and noteworthy materials-handling provisions highlight Johnson & Johnson's new 15-acre manufacturing center. Electrical installation was by three New Jersey contractors.

By **Max H. Schwarz,** *Chief of Electrical Design*
Walter Kidde Constructors, Inc., New York, N. Y.



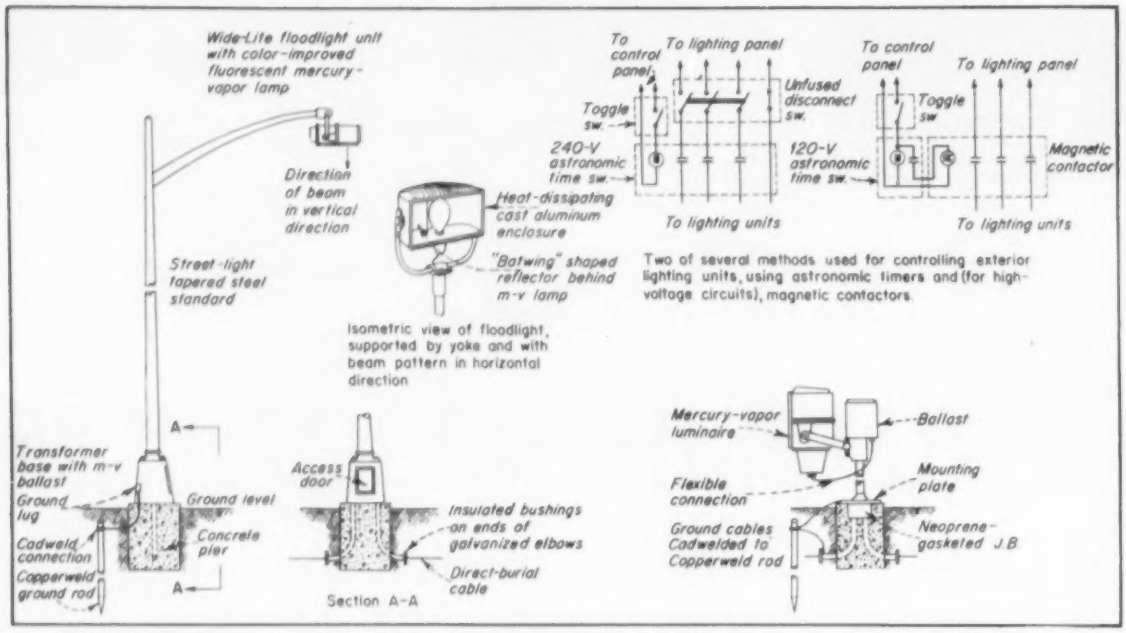
DOUBLE-PARABOLIC specular aluminum reflector directs bounce-light around lamp to boost lumen output, while cast-aluminum fins on top and bottom of enclosure dissipate heat rapidly. Tempered glass covers, adjustable mounting yokes and vibration-resistant sockets are other features in this luminaire that can contain standard incandescent or (to take full advantage of the design) color-improved fluorescent mercury vapor lamps.

JOHNSON & Johnson's new manufacturing center in North Brunswick, N. J., is attracting widespread interest from electrical and construction men alike; for this comment-provoking group of progressively-modern structures incorporates numerous electrical features of a pioneering nature, introduces a new concept concerning the physical evolution of an industrial plant, and reverses a building trend which has been a J&J hallmark for many years.

Special comment begins with exterior illumination, since roadways, parking areas and building-facade floodlighting is accomplished by unique batwing-shaped specular-aluminum reflector units designed specifically to obtain maximum controlled light output from color-improved fluorescent mercury-vapor lamps. A radical departure from conventional parabolic reflectors, these luminaires are rectangular in front elevation, modified-double-parabolic in plan, and constructed with cast-aluminum heat-dissipating finned enclosures. Lenses are of tempered glass and (so as to remove all possible sources for trapping inter-reflected bounce-light within fixtures), vibration-resistant sockets are recessed outside the enclosures proper.

New Design of M-V Luminaire

The result of matching the relatively large luminous light source of a fluorescent-mercury lamp with the butterfly design of the reflector is impressive, for (with a measured reflection factor of 85%), 400-watt lamps have light outputs of 20,000 lumens, while a thousand-watt lamp (1090 watts overall including ballast), has an output in the order of 50,000 lumens. Even when inside-frosted incandescent lamps are used (instead of color-improved fluorescent mercury-vapors), outputs for 1000- and 1500-watt lamps



EXTERIOR LUMINAIRES are variously mounted as high as **35 ft** above ground, atop tapered and cambered-arm standards, or at ground level on short pipe standards. All supporting mediums are secured to concrete piers, while grounding of metal enclosures is by means of lugs and flexible leads Cadwelded to Copperweld rods. Control circuits incorporate astronomic timers and magnetic contactors.

approximate 21- and 33-thousand lumens.

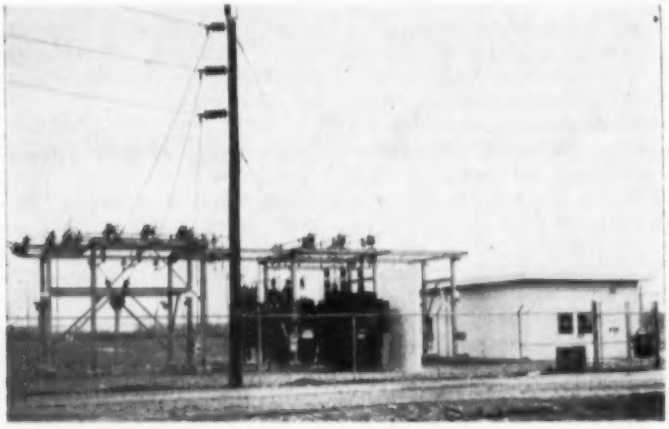
Including mounting yokes, units range in width from 26 to 30 in., in depth from 10 to 13 in., in height above bracket connections from 25 to 31 in., and in weight from 47 to 55 lbs.

The larger luminaires, having beam spreads of 140 degrees horizontally and 60 degrees vertically, are used as high-intensity high-elevation weatherproof units to illuminate J&J's large-area parking lots, while smaller units (lamped variously with either mercury or incandescent lamps, depending upon position and application), are used to illuminate roadways and architectural building features. In this latter application (due to smooth overlapping of beam patterns from adjacent fixtures), floodlighting of building facades is unusually even in overall intensity; being devoid of either hot-spots or shadows.

High-elevation luminaires (mounting heights ranging up to 35 ft) are yoke-connected to tapered pole standards (some with and others without cambered arms). Standards, in turn, are mounted atop ballast - containing transformer bases and concrete piers. Luminaires mounted at "ground" level are actually supported by short-length pipe pedestals flange-mounted to pier-bolted bearing plates.

In all cases, transformer bases, bearing plates and related outsweeping underground conduit elbows (installed for the containment of direct-burial multiple-circuit wiring) are separately grounded via lugs and bare copper No. 6 cables Cadwelded to 1-in. 10 ft Copperweld rods.

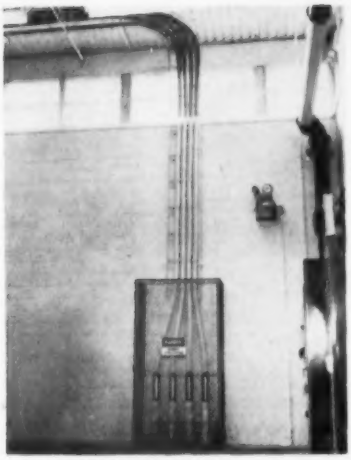
Outsweeping elbows (plus galvanized rigid-steel sleeves placed beneath roadways, railway sidings, paved parking areas and drainage ditches) are equipped with insulated end bushings and are positioned 2 ft below ground level. Direct-burial cables extending between these items are continuously covered by creosoted planks as protection against digging or any undue pressure from vehicles, etc.



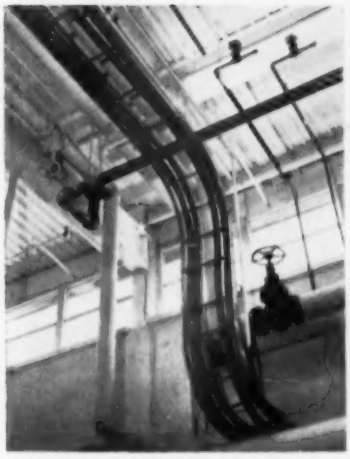
PRIMARY POWER at 26.4-kv is received via overhead utility line, then stepped to the initial distribution level of 4160-volt through 2500-kva transformers; space being available for doubling this capacity when needed for plant expansion. Secondary windings of transformers are connected through key-interlocked draw-out breakers to common bus structure, with feeders then dropping underground for entrance into the plant proper.

Control Variations

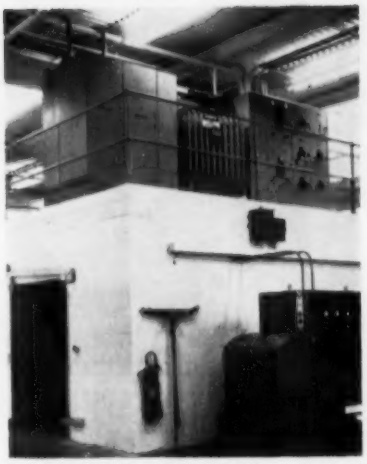
Depending upon voltage level of exterior-lighting circuits, luminaires are controlled either directly



4160-VOLT FEEDERS are tapped at manholes along underground route, with branch feeders for each substation entering manufacturing buildings via ducts and upsweeping conduits. Feeders (consisting of 3-single-conductor 5-kv 500MCM VCL cables) then change (via special joints) to armored cable for continuation to substations. As noted above, entering conduits are racked and grounded via lugs and straps.



ARMORED CABLE FEEDERS are secured to and supported by ladder racks which in turn are secured to structural columns or roof beams. Routing by this means promotes flexibility, ease of installation, availability for tapping and inspection, plus current-carrying capacities.



THIS INDOOR SUBSTATION is located atop concrete-block storage vault, thereby elevating transformers and switchgear above the manufacturing area, minimizing likelihood of unauthorized persons touching the equipment, and providing additional useable floor space for other purposes. Substations (five installed at present) step voltage down to 480/277-volt for general plant power and lighting purposes.

by single-phase 120- or 3-phase 120/208-volt motorized astronomic time switches or (where lighting circuit voltage is 440) by time switches that, in turn, activate 120-volt holding coils of 480-volt magnetic contactors. In both instances, time-switch motors can be de-energized by single-throw toggles located on in-plant panelboards, while lighting circuits themselves may or may not be additionally equipped with unfused disconnect switches.

In addition to these special Wide-Lite luminaires, exterior lighting includes low ornamental mushroom-hood mercury-vapor walkway floodlight units, conventional m-v floods for illumination of outdoor signs, plus obstruction lights atop a gravity water tank (photo-cell controlled for dusk or cloudy-sky activation).

Variety of control also pertains to interior lighting, for production-area illumination (operating from 480/277-volt feeders) may be initiated either (1) remotely (through 110-volt pushbutton stations and holding coils of 440-volt magnetic contactors), or (2) locally (by means of 277-volt toggle switches positioned against webs of structural columns in those areas where local control of general or night lighting is considered necessary or advantageous).

Remote plus Local Switching

Current for low-voltage remote-control circuiting is obtained through single-phase 440/110-volt control transformers (mounted in the 480-volt contactors which service specific groups of lighting fixtures). Transformer primaries are connected phase-to-phase into the 4-wire lighting circuit to which they are related (see diagram). Related 480/277-volt contactors are fused for 20-amps per phase, i.e., for a limit of 18 800-ma 2-lamp lighting fixtures. This means that a 3-pole contactor would handle 54 fixtures or (with the number of fixtures per 41- by 41-ft bay ranging from 6 to 12, depending upon production lighting requirements) one remote-control switch would control the lighting for 10,000-15,000 sq ft of factory space. Fixtures are 2-lamp open-end units equipped with 100-watt cool-white rapid-start lamps. And, operating as they do at 800-milliamps, lumen output per fixture is approximately 14,500 (about 35% higher than a comparable slimline installation operating at 425 ma). Resulting intensities on working surfaces vary between 35-55 fc (depending upon local requirements), while corresponding current consumption averages 1¼ w/sf.

Smaller groups of fixtures in these same production areas are controlled by local manually operated 277-volt switches. Switches are connected phase-to-neutral through the specific groups of fixtures to be activated by this means (in accordance with Section 2113 of the NEC).

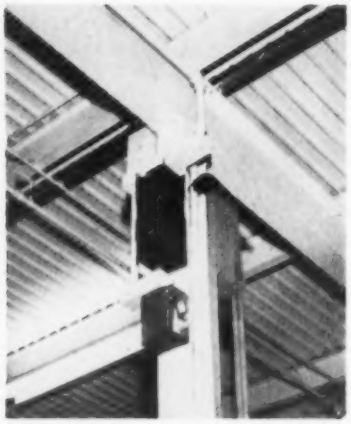
In office sections of the plant, illumination is conventional continuous louvered troffers, operating current being at 120 volts and (depending upon illumination levels desired), rows of lamps within the troffers varying from two to three. Corresponding footcandle levels vary between 50 and 65.

Dual Primary Service

Primary power at 26.4 kv (3-phase delta) is obtained from two separate utility networks, service to plant substation being by overhead line through electrically-interlocked motor-operated horngaps to a common high-tension bus structure. Twin 2500-kva transformers (with space provided for an additional two units) are connected on their primary sides to this common bus and (through key-interlocked draw-out breakers) on their secondary sides to a common 4160-volt bus. Secondary feeders (likewise protected by drawout air circuit breakers) then proceed underground to the plant proper.

MOTOR CONTROL CENTERS, strategically located throughout the plant, promote convenience of operating production equipment. Majority of motors in plant (⅓ hp or larger) operate at 480 volts, although a few major motors are connected through combination starters (with low-voltage switches and holding coils) directly to 4160-volt feeders.

INTERIOR LIGHTING in industrial areas is provided by 277-volt 2-lamp open-end and open-bottom luminaires equipped with rapid-start 100-watt cool-white lamps. Fixtures per bay range from 6 to 12, while corresponding footcandle levels vary between 35-55. Average lighting load approximates 1¼ w/sf. Photograph also shows general construction details, ventilation ductwork, path of Towveyors and plantwide communication equipment



LOCAL APPLICATIONS using 120/208-volt power, such as machines and appliances in kitchen and office sections, obtain current through dry-type 3-phase transformers which are served through adjacent power panels or 480/277-volt lighting feeders.

Feeders for the plant (each consisting of three single-conductor 5-kv 500MCM VCL cables) are carried between manholes of the underground routing system through concrete-encased fiber ducts; transition from outdoor sub breakers to underground installation is effected through potheads and conduit-to-duct fittings.

Five indoor unit substations (with provisions for three more) serve the shipping center, various manufacturing structures and boiler house; primary 4160-volt feeders being arranged to provide selective-primary service to each of these unit substations.

These indoor subs reduce voltage to 480/277-volt (wye connected) for general plant power and lighting applications, although major items of power equipment (such as refrigeration compressors, banburies, sheeters, mills and the like) are connected directly to the main 4160-volt feeders. Equipment operating at the 120/208-volt level (office lighting and business machines, cafeteria kitchen, etc.) is served locally through tertiary dry-type 3-phase transformers served by near-by power panels or lighting feeders.

Distribution at 4160, 480, and 277 Volts

Main underground 4160-volt VCL feeders enter the shipping center through upsweeping galvanized rigid-steel conduits, connecting at this entrance point to flexible armored cables for continuation onwards to indoor substation locations. Many secondary 480/277-volt feeders radiating from substations are likewise armored. These cables are supported by overhead metal-mesh racks mounted to structural columns and girders. Flexibility of routing, availability for tapping and inspection, ease of installation and improved current-carrying ratings were among benefits obtained by this method of distribution.

All other secondary circuiting is by cable in conduit, routed either overhead through roof-truss space or carried in floorslabs, depending upon location and nature of the production equipment to be served.

In office areas, branch circuiting also includes the use of 2-cell (power plus telephone) underfloor-ducts and (in those areas where desks are positioned immediately adjacent to exterior walls) the additional use of plug-in ducts surface-mounted to outer walls in the open space normally found beneath continuous under-window finned radiator enclosures.

For convenience of production-equipment operation, numerous motor-control centers are installed within the plant. Motors smaller than ½-hp are 120-volt single-phase; motors of ½-hp rating or larger are 3-phase 480-volt (except for those major 4160-volt units which are controlled through combination starters equipped with low-voltage switches and holding coils).

Grounding throughout the plant is both positive and extensive; a complete ground bus encloses the outdoor substation, all structural columns and exterior lighting standards connected to Copperweld ground rods via bare copper cable and Cadweld joints, and all electrical conduit, enclosures and bases (plus the outside sprinkler loop) connected by grounding cables to the structural steel.

Outstanding Material-handling Methods

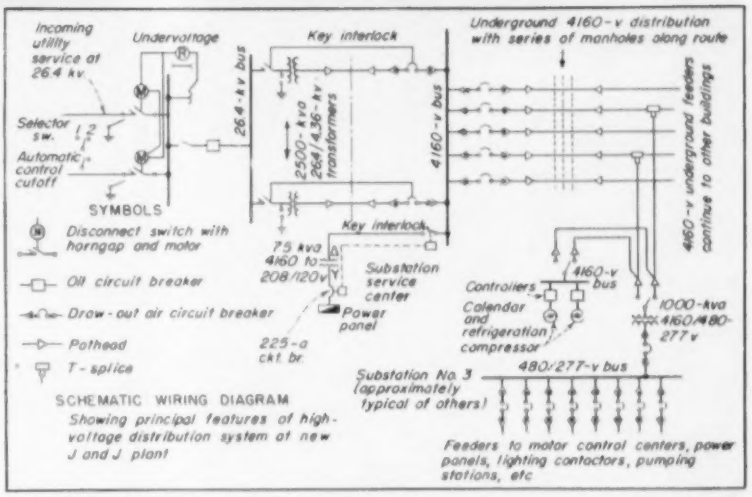
Practical electrical planning is also reflected by many features related to the handling of materials, for a wide range of electrical devices and components are evident (1) at truck- and railroad-receiving and shipping docks, (2) in connection with extensive automatic Towveyor system serving all production buildings, and (3) on battery-operated fork-lift and pallet trucks.

For example: truck and railway shipping docks are equipped with motorized roll-up doors, interlocked warning lights and audible signaling devices, unit heaters that automatically release blasts of warmth when exterior doors are raised, Reelite cables equipped with extension lights which may be carried inside truck and boxcar bodies to provide local illumination, plus adjustable loading-platform aprons that move upwards, downwards or outwards to exactly meet truck tailgates or boxcar door sills.

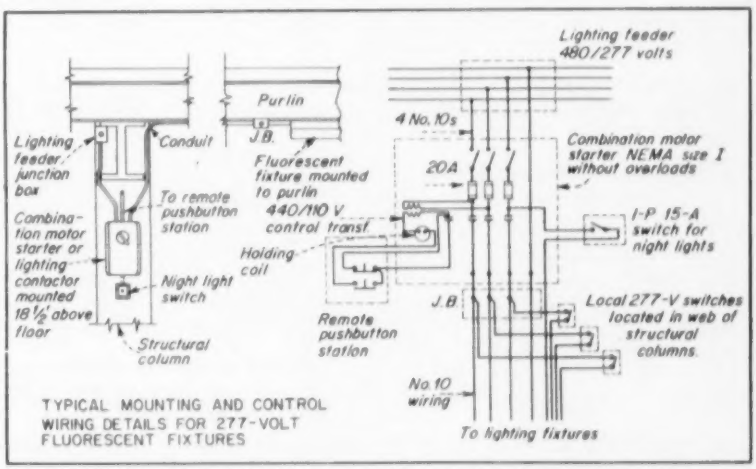
Also electrically noteworthy is the plant-wide Towveyor system, literally an all-purpose completely-automatic trolley installation that delivers loaded dolly trucks (unattended by drivers) to or from any one of 20 separate production, storage or shipping stations within the three factory buildings presently comprising this industrial center.

With numerous underfloor chainlines serving the plant, hefty motors to keep chainlines in operation, interlocks to prevent piling-up or jamming of truck at intersection points of converging routes, electronic controls for self-routing, and easily attached and detached chain locks, this system practically eliminates supervisory attention, makes it possible for personnel to remain within a local area of operation, and cuts materials-handling costs drastically as a result.

Details of electronic controllers



SCHEMATIC WIRING diagram indicates relative positioning of incoming 26.4-kv services; high-and low-voltage bus structures; transformers for stepping current progressively to 4160-, 480/277- and 208/120-volt; both underground (duct contained) and overhead interior (armored cable) feeders; plus switching arrangement to permit selection of alternate 4160-volt feeder routes between outdoor and indoor substation.


Lighting feeder 480/277 volts
Purlin
Conduit
J.B.
Lighting feeder junction box
Fluorescent fixture mounted to purlin
4 No. 10s
Combination motor starter NEMA size 1 without overloads
20A
To remote pushbutton station
440/110 V control transf.
Combination motor starter or lighting contactor mounted 18½' above floor
Holding coil
1-P 15-A switch for night lights
Night light switch
J.B.
Local 277-V switches located in web of structural columns.
Remote pushbutton station
Structural column
No. 10 wiring
TYPICAL MOUNTING AND CONTROL WIRING DETAILS FOR 277-VOLT FLUORESCENT FIXTURES
To lighting fixtures

VARIETY OF CONTROL for 277-volt interior lighting installation includes remote 110-volt pushbutton stations and holding coils, plus local 277-volt toggle switches. Current for low-voltage remote-control circuits is obtained through single-phase 440/110-volt control transformers incorporated in the 480-volt contactor assemblies that relate to specific groups of luminaires. Contactors are mounted on structural columns well above floor level.

are beyond the scope of this discussion, except to note that they permit dispatchers to "dial" any one of 20 possible destinations, attach dollies to the nearest Towveyor line, then let the dollies select and follow the most direct routes to the destinations to be reached.

Equally comment-worthy is the battery-truck operation, for all trucks are equipped with 2-way radio-phones that permit a central supervisor to check, direct and route vehicles quickly and efficiently. With handphones, speakers, tuners and transmitting equipment conveniently arranged on truck dashboards and chassis, drivers can receive and transmit messages clearly and promptly. Also, since the central supervisor is flanked by large pegboards (indicating column lines and pallet bays in all industrial buildings), and since these boards are equipped with movable colored pegs (to indicate exact positions of all trucks at all times), the supervisor can locate, contact and route trucks with minimum travel distances and minimum travel times involved. Since trucks are serviced and batteries are recharged at in-plant maintenance centers, this operation

CENTRAL SUPERVISION for operation of battery-trucks is obtained through 2-way radio-phone installation that establishes communication contact between dispatcher and all truck operators. Pegboards (with holes relatively placed in accordance with column lines and pallet bays in each industrial building) permit shifting of colored pegs that visually indicate location of all trucks at all times.

BATTERY TRUCKS are equipped with 2-way radio-phone hand speakers and receivers, plus tuners and transmitting equipment conveniently arranged on dashboard or chassis of vehicle. Reception in all parts of the plant is clear, and installation results in eliminating delays in contacting drivers, minimizing routing distances and time intervals between successive trips.

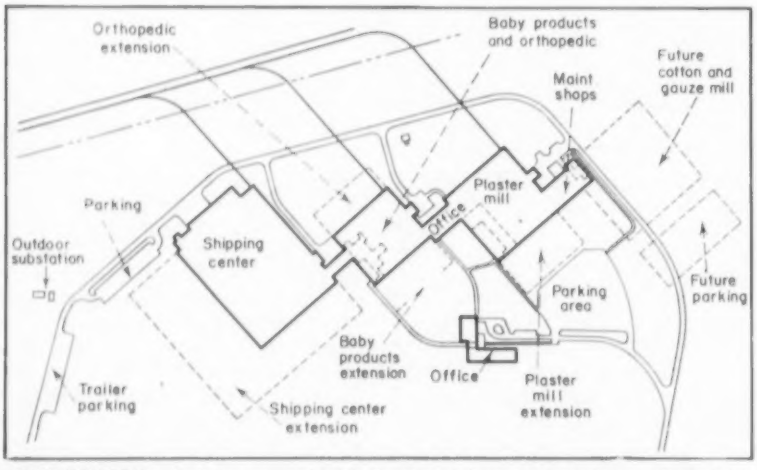
constitutes yet another cost-cutting efficiency-promoting industrial medium.

Interplant Communication System

While on the subject of communications, it is also pertinent to mention that, in addition to normal paging and musical transcription facilities, this system has a direct telephone-line connection linked with J&J's headquarters plant in nearby New Brunswick. With this setup, announcements or programs of company-wide interest may be initiated from headquarters, announcements of local interest may be initiated from the broadcast center of this new plant, and sound may be transmitted to the plant in general or to any separate building or production area in particular, depending upon the nature of the announcement of transcription.

New Concept in Design

As to the new concept of physical layout, this plant evolved through a reversal of normal architectural design procedures. That is, instead of first creating a structure and then juggling equipment and services to fit into it, the designers in this case first determined a practical arrangement of all facilities, then located walls to encompass these various functional areas. In this way an ideal routing and related-area scheme was developed. Then this ideal plan was exactly *doubled* in scope to provide for a liberal growth expectancy. Receiving and shipping facilities came next; materials-handling and electrical distribution systems were added; other building services and utilities were similarly located; and the resultant 15-acre group of buildings (most of them with expandable walls) was constructed in the center of a 300-acre site between a main highway (US Route 1) and the main right-of-way of an arterial railroad (the Pennsylvania).



NEW CONCEPT of design started with functional layout of facilities, after which building walls were located to enclose this functional arrangement. This ideal plan was then doubled in scope to provide for expected future growth, and buildings were staggered to permit 2-way further expansion of each manufacturing building without necessitating the shifting of already-established production operations.

As indicated by the accompanying plot plan, this functional layout approach has numerous plus values, for separate buildings maintain J&J's long-held policy of establishing autonomous divisions, yet their close proximity to office and laboratory areas promotes operational cohesiveness and minimizes duplication of supervisory and control facilities. Moreover, with buildings

TRUCK BATTERIES are recharged at strategically-scattered centers, while all servicing (mechanical and electrical alike, for trucks plus radio-phone equipment) is also performed by J&J's maintenance crew. Use of radio-phone equipment permits instant contacting of all battery trucks operating in the plant, while peg-board dispatch system eliminates confusion and distance-wasting routing orders.

SHIPPING DOCKS are equipped with motorized roll-up doors, interlocked warning lights and audible signaling devices, unit heaters that automatically release hot air blasts when exterior doors are raised, extension cables on spring-tensioned reels (to permit temporary lights to be carried directly inside bodies of trucks), and adjustable loading aprons that can be raised, lowered or projected to coincide with loading level.

arranged in a staggered pattern as they are, each division can expand in either or both of two directions as growth dictates, without necessitating the shifting of already-established production operations.

A third advantage is in the location of labs and office areas directly related to factory operations, for these sections are constructed as connecting links *between* main buildings, out of the paths of possible expansion, yet close to the operations to which they are related. Still another advantage pertains to separate railroad spurs swinging in to serve the three main factory structures, for this arrangement promotes greater flexibility for scheduling incoming deliveries and outgoing shipments, and (theoretically at least), it greatly lessens space requirements for the storage of raw materials.

From an architectural point of view, this arrangement has the additional advantage of establishing wider latitudes for creative expression in building composition, arrangement, fenestration, use of color, landscaping and lighting—all of these elements adding up to a strikingly - attractive industrial plant which already is a source of pride for management, labor and the community as well. As with all modern plants of this type, close integration of building design, functional facilities and operational requirements was a major engineering concept.

Reversal of a Building Trend

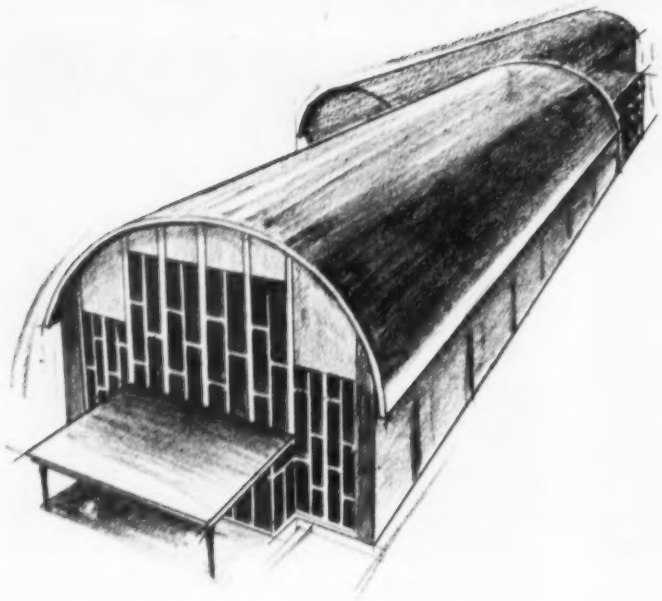
This plant departs from J&J's former policy of locating self-contained plants in numerous decentralized locations, each plant having its own autonomous organization, service facilities, receiving and shipping arrangements and so on. Decentralization had shown many positive advantages—that is, it had until recent stepped up production quotas started a widespread chain reaction of shoehorn additions, overloaded electrical systems, strained distribution setups and production departments literally bursting at the seams for want of sufficient space.

This new plant falls considerably short of concentrating *all* of J&J's operations under a single roof, yet it *does* group several related divisions into a practical arrangement which possesses sufficient flexibility and space to handle many years of normal growth, and it meets J&J's objective of building the world's largest and most modern plant for the manufacture of the surgical dressings and baby products for which they are so well known.

Physically speaking, each of the present three main factory structures is of steel-frame cantilever construction, with concrete blocks set between columns spaced on 41-ft centers (sufficient to encompass ten rows of pallets). Roof girders are set 20 ft above floor level, with monitors providing fire-control vents, additional daylight, plus a means for enclosing a variety of ductwork. To minimize sky brightness, those windows facing north are constructed of blue glass.

And, for additional color relief, building walls are generally white, cover plates over exposed columns and girders are blue enamel, and certain office portions are of red glazed brick. Each building contains its own supervisory, personnel and service facilities, while a central office and cafeteria group contains administrative, conference, eating and medical provisions.

Architectural creation plus complete designing of the plant was the work of Walter Kiddie Constructors, Inc., New York City, who worked closely with J&J manufacturing and service officials to develop this functionally efficient industrial center. Credit for installing all electrical service and lighting facilities goes to James H. DeLaplaine, of Highland Park, while wiring and control equipment related to process operations within the plant was installed partly by the S&M Electrical Contractors of Rahway, and partly by the C&M Electrical Contracting Company of Milltown, all located in N. J.



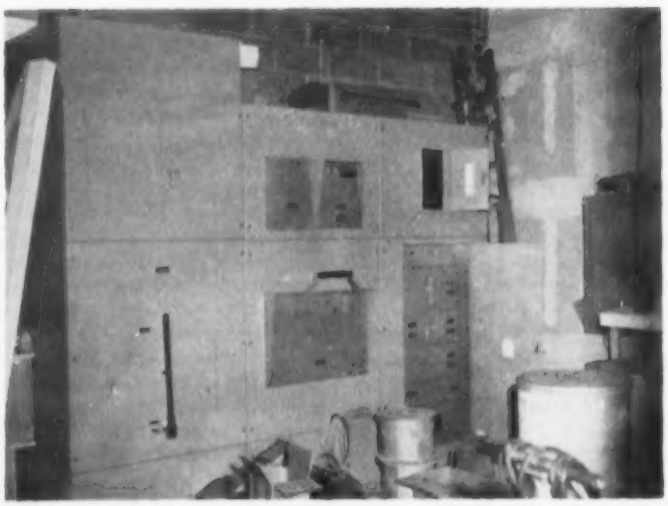
TRANSFORMER VAULT is an open shed

Skillful engineering combines . . .

Busway and NM Cable for Store Wiring

Design and installation details of a modern electrical system carefully matched in capacity and characteristics to the requirements of Modell's Shoppers World—a large discount department store in Lodi, N. J.

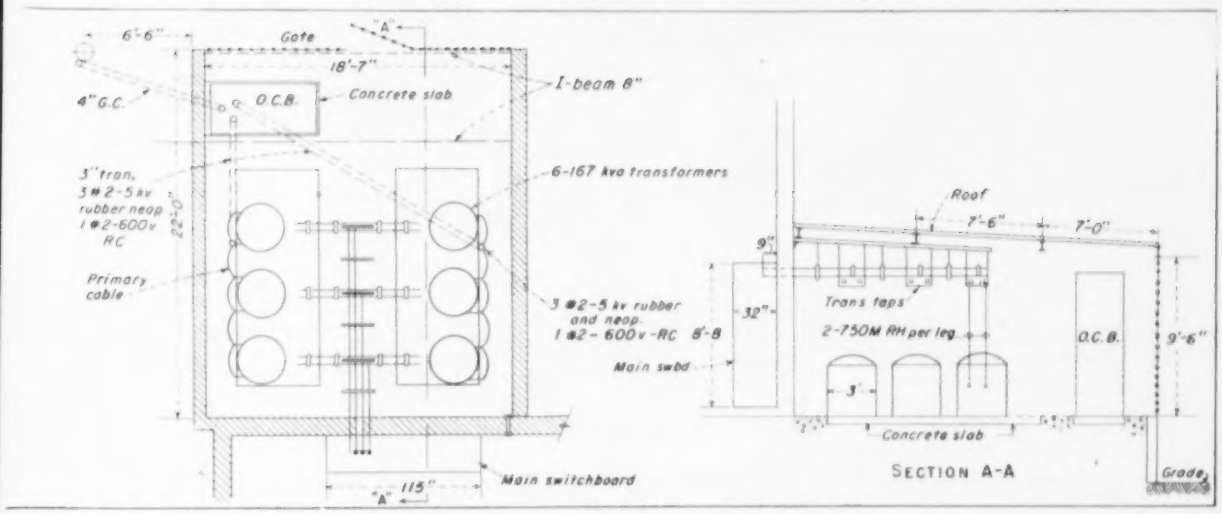
By Arthur N. Reichel, *President*
New Jersey Electrical Engineering, Inc., Englewood, N. J.



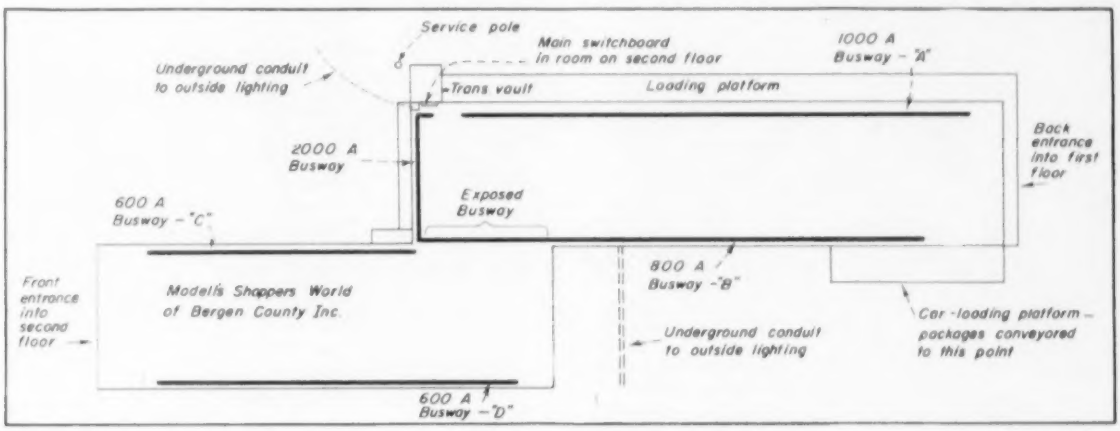
MAIN SWITCHBOARD is installed in electric room on second floor which is the ground level floor at one end of the building. Other floor of building is below this.

ELECTRIFICATION of Modell's Shoppers World, Lodi, N. J., is based on two different wiring methods—busway for main distribution and type NM (non-metallic sheathed) cable for branch circuiting. This unusual combination of methods was used to meet design objectives of economy, high capacity and flexibility. Overall, from service to loads, the system is modern and highly functional, providing efficient and convenient electrical utilization.

Power supply to the building is made at primary voltage from a utility overhead line. A 3-phase, 4-wire, 4160/2300-volt service feeder originates at a utility pole adjacent to a transformer vault at the side corner of the building. From fused cutouts on the pole crossarm, the conductors are carried down the pole into conduit on



fed by overhead primary utility line, then underground from pole shown.



PLAN OF BUILDING shows layout of busway runs around store at ceiling level of first floor. All busway is concealed behind walls of display areas, except the length of 800-amp busway indicated.

the pole, then underground and up into a weatherproof enclosure for a primary oil circuit breaker in the transformer vault.

The transformer vault is an open shed made up of two walls of 12-in. concrete blocks extending from the store building, with a metal fire-resistant roof and a wire fence and gate on the open side. This vault houses the primary oil circuit breaker and six 167-kva single-phase transformers, two per phase —connected 2300/4160 volts, 3-phase, 4-wire primary to a 3-phase, 4-wire, 120/208-volt secondary. In the vault, a 3/0 copper ground wire is used to ground all exposed metal —including service conduit, transformers, secondary busway framework and the fence across the open

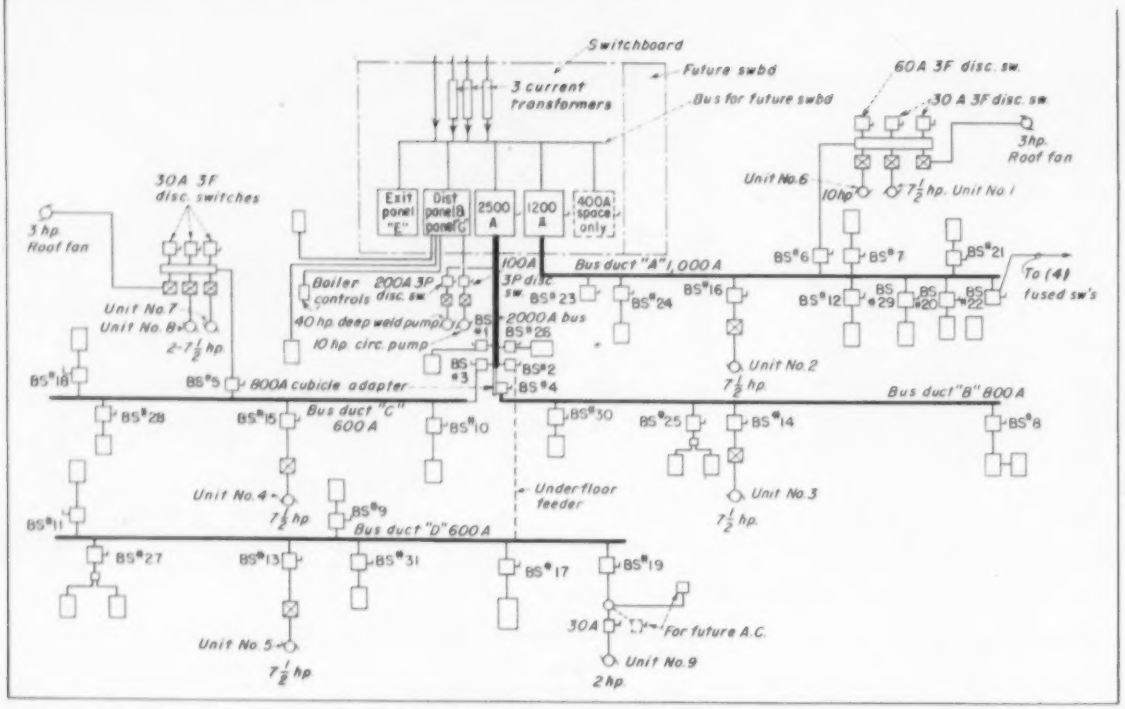
Design Background

In Bergen County, N. J., a suburb of New York City, the national trend toward highway shopping has brought with it construction of a number of giant discount department stores. These stores specialize in low-margin, discount selling of very wide lines of merchandise, and competition among the stores is stiff. To assure low overhead essential to discount selling, construction of these stores places heavy emphasis on economy. However, heavy emphasis is also being placed on facilities which add speed, ease and efficiency to selling operations and comfort and convenience to customers.

Design of an electrical system to serve a discount department store demands capable engineering to reconcile economy with full-capacity, reliable operation. But it can be done—and in spades. The designer must fully understand the operating theory behind such stores and must work closely with store management. But most important, he must adopt an imaginative, creative approach to the task.

The story here describes the electrification of New Jersey's largest discount department store. This store is a two level building located on a major highway. Food, clothing and home furnishings—in wide varieties of famous brands—are sold here at discount prices. The entire operation—the product of years of study—is carefully geared to the modern type of highway discount shopping. Emphasis is on function—lighting is high level throughout and decorative at entrances, the entire building is air conditioned and a system of conveyors provides fast and effective delivery of customer's packages to an outside station where the packages are loaded into customers' cars.

Although the above mentioned mechanization has greatly increased efficiency, to help make possible large-volume, low-margin selling, overall construction of the store is also a factor in low overhead operation. The building is a clean, functional structure. The electrical system has full capacity and is highly reliable, flexible and economical. Because the nature of the system is somewhat unique and because this type of store represents a trend, the installation is significant.—THE EDITOR



ONE-LINE DIAGRAM of overall electrical system from main switchboard points up substantial electrification of the store building, including power distribution for air conditioning of the entire building by unit conditioners. Taps up from busway go to second floor; taps down, to first floor.

BUS SWITCHES

B.S. #					
1	200)		Panel "A"	4-3/0	2½" C.
2	600)	Bolted to Dist. Bus	Bus Duct "D"	3-350 M & 1-1/0 in each C.	2-3" F. C.
3	600)		Bus Duct "C"	7-350 M	4" C.
4	800)		Bus Duct "B"	800 A Bus to Distr. Bus	
5	100		Units 7 & 8: 2-7½ HP & 1-3 HP Roof Fan	3 #4	
6	100		Units 1&6: 1-7½ & 1-10 HP & 1-3 HP Roof Fan	3 #4	
7	200		Panel "C"	4 #1/0	2" C.
8	200		Panel "M" & Panel "J"	4 #1/0	2" C.
9	Future for sign	60	Panel "K"		
10	200		Panel "D"	4 #2/0	2½" C.
11	200		Panel "H" Entrance Panel	4 #1/0	2" C.
12	200		Panel "N"	4 #2	2" C.
13	30		Unit No. 5-7½ HP	3 #10	
14	30		Unit No. 3-7½ HP	3 #10	
15	30		Unit No. 4-7½ HP	3 #10	
16	30		Unit No. 2-7½ HP	3 #10	
17	60		Unit Panel "L"	4 #4	1½" C.
18	200		Panel "P"	4 #1	2" C.
19	30		Unit No. 9-2 HP	3 #10	
20	100		Panel "R" & Panel "T"	4 #4	
21	60		Panel "S"	4 #6	
22	200		1-3 HP Pump, 1-HP Fan & 8 racks	3 #2/0	2" EMT.
23	100		Panel "V"	4 #4	
24	100		Sign & Panel "DD"	4 #8	
25	100		Outside Lighting & Panel "CC"	4 #8	
26	30	2 fuse SN	China Department Panel "Y"	3 #8	
27	100		Panel "Z" & "AA" } Lamps	4 #4	
28	100		Panel "BB" }	4 #4	
29	100		Panel "EE" (5 Ice Cream Cab.)	4 #4	
30	30		Panel "FF" (Sporting Goods)	3 #8	
31			Panel "GG"		

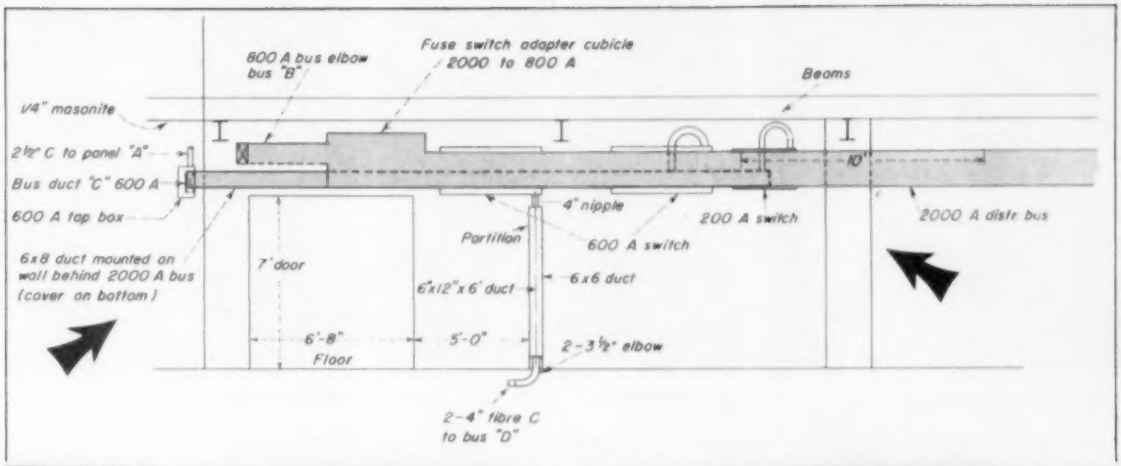
side. This ground wire was run to the vault from the building water meter.

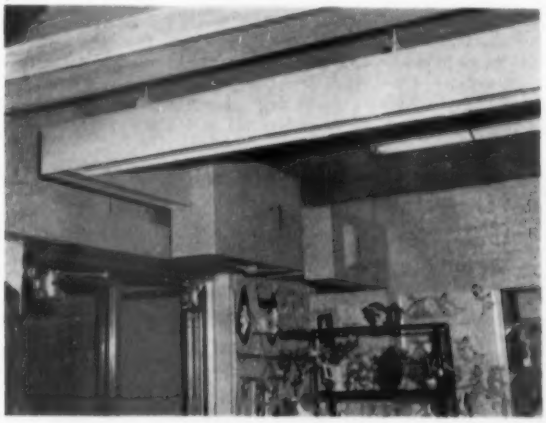
Primary supply conductors to each of the two banks of three service transformers are run in asbestos-cement duct under the slab from the OCB enclosure. A duct run to each bank carries three No. 2, 5000-volt rubber and neoprene conductors and one No. 2, 600-volt rubber insulated conductor. A length of 2000-amp single-phase busway is used to parallel the secondary connections of each of the three pairs of transformers and to connect each pair to one phase of a main 3000-amp copper busway. This main busway is a 3-phase, 4-wire feeder from the vault through the building wall into the main switchboard in an adjoining electric room. It is supported in the vault by hangers from a frame assembly.

The main switchboard contains two main disconnects and two panelboards—all fed from the bus in the switchboard. One of the main disconnects is a 2500-amp Pringle switch, fused at 1350 amps feeding a 2000-amp, 3-phase, 4-wire ventilated distribution busway. The other main disconnect is a 1200-amp, arc-quenching, fused switch feeding a 1000-amp, 3-phase, 4-wire plug-in busway run.

The two panelboards in the switchboard are also tapped from the same bus as the two main disconnects. One panelboard is supplied through a 400-amp main switch and serves small local power and lighting loads. The other panelboard is fed through its own 50-amp main switch and serves "Exit" lighting circuits throughout the building. Provision is made in the switchboard for addition of another 400-amp main switch to meet future load expansion.

As shown in accompanying one line diagram, distribution throughout the building is made over bus-

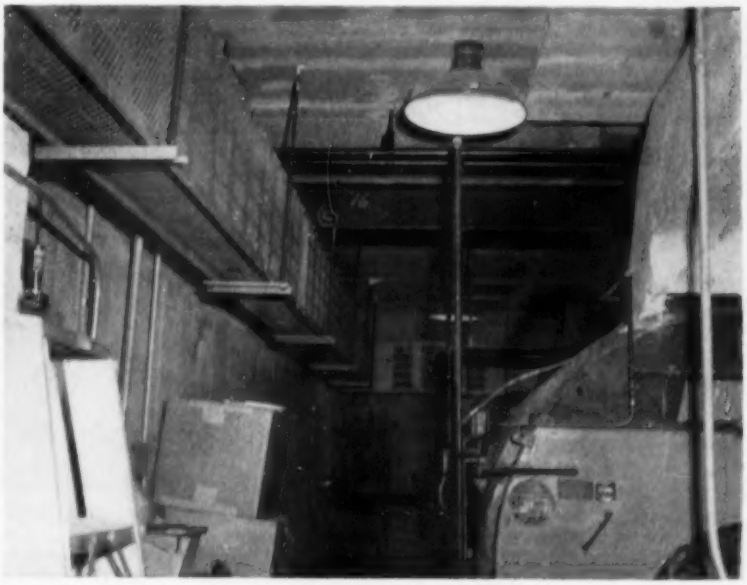




BUSWAY DETAILS are shown here at the junction of 2000-amp busway and 800-amp busway. Wireway feeds 600-amp busway through 600-amp switch, and second 600-amp switch feeds other 600-amp busway under floor slab. Photo at left shows 800-amp busway, wireway to one 600-amp busway and 600-amp switch feeding underground to second 600-amp busway. Photo at right was taken behind partition from which 2000-amp busway emerges in photo at left. Two switches shown—200-amp and 600-amp—tap 2000-amp busway into wireway to feed a panelboard and 600-amp busway. Arrows indicate angles of photos.

way. The 2000-amp feeder busway from the 2500-amp main disconnect feeds three other runs of plug-in busway—one 800-amp and two 600-amp 3-phase, 4-wire busways. From these busway runs, subfeeders and motor branch circuits are tapped to loads on both floors through fusible type plug-in bus switches. Above the first floor slab, exposed and concealed conduit runs are used for subfeeds and circuit taps. Electrical metallic tubing is used for sizes from ½ in. to 2 in.; and rigid conduit for sizes larger than 2 in. Flexible metal conduit is also widely used for subfeeders.

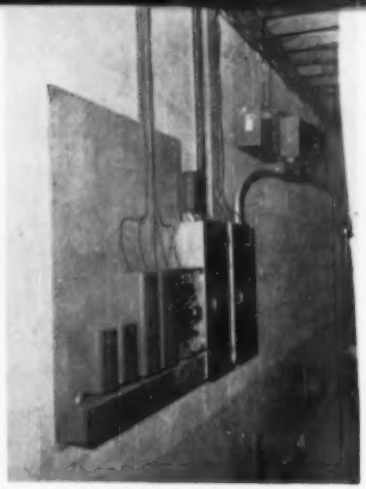
For branch circuit wiring, type NM cable is widely used throughout the building. No conductor smaller than No. 12 is used for branch circuits. A requirement in the specs for the job called for No. 10 conductors for 20-amp branch circuits supplying fluorescent lighting when the distance from the



2000-A BUSWAY is shown here in the boiler room, under the electric room containing the main switchboard which feeds down to this busway.

FLEXIBLE CONDUIT feeds three No. 8's to small lighting panelboard from 30-amp, 2-fuse-SN tap switch on 2000-amp busway out of sight to right. Lighting branch circuits use type NM cable. Other lighting panelboards in the building are much larger than this—20- and 36-circuit panels. On almost all of the panelboards, the outgoing type NM branch circuits are neatly arranged in a vertical wireway riser with removable cover.

TAP SWITCH at end of 600A busway "C," near front of store, is a 200-amp fused switch feeding four No. 1's in 2-inch conduit up to 36-circuit lighting panel on second floor. Switch next back on busway is a 100-amp switch feeding four No. 4's in flexible metal conduit to a nearby 20-circuit lighting panel on same floor. Flex subfeeders to panelboards are supported by clamps on studs and floor joists.



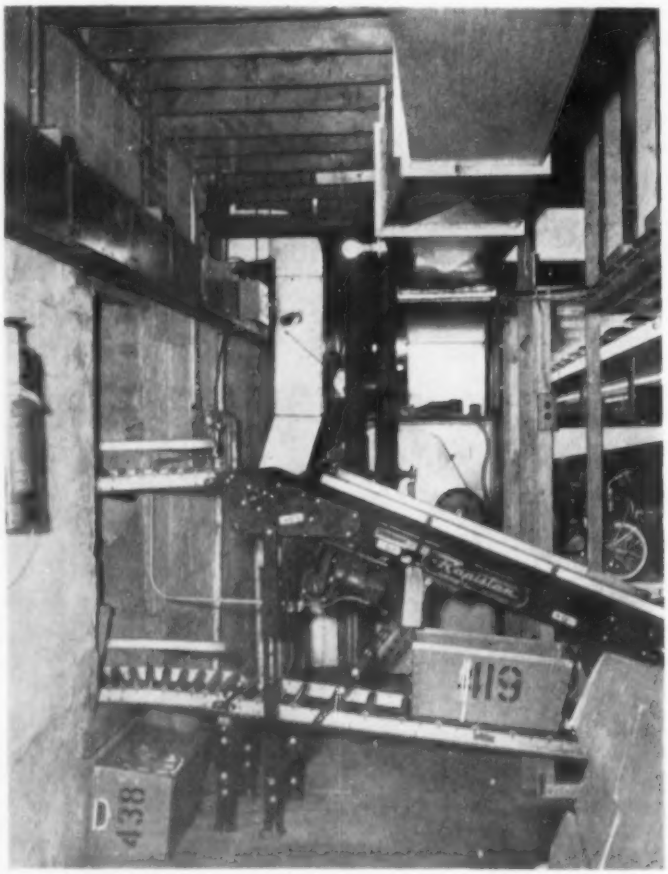
MOTOR CONTROLS (one uncovered) for part of conveyor system are mounted on plywood panel on wall adjacent to end of 800-amp busway "B" near back of building. The panelboard closest to the controllers contains seven 3-pole breakers for branch circuit overcurrent protection and disconnecting of motor circuits. Relays at left of starters provide forward and reverse control. Tap from busway is shown at upper left.

panelboard to the last connection is longer than 100 ft. The specs also called for branch circuits to be installed in a loop system and of continuous length as long as practical with a minimum amount of cutting. Slack for tapping off was left in each outlet box. The specs also called attention to the wiring of multi-wire branch circuits—ungrounded conductors using a common neutral for more than one 2-wire circuit must originate from different phases in the panelboard. The non-metallic sheathed cable is used where the wiring is not installed in masonry, and the cable is equipped with an equipment grounding conductor.

Wiring details on this job were carefully set out in the specs. Cable or wire larger than No. 8 size was terminated in solderless, mechanical lugs. Taps in panel gutters were made with solderless, mechanical connectors with insulated jackets. For fixture connections, splices were required to be either soldered and insulated with rubber and friction tapes or made with insulated wire connectors.

The electrical system also includes other modern features. General area fluorescent lighting is controlled by remotely operated relays. Mercury vapor floodlighting is used for the parking lot. And a modern public address system is an important store facility.

Installation of the electrical system at Modell's was made by Jeb Electric Co., Park Ridge, N. J.



POWER LOADS throughout building are made up of air conditioning units (one shown behind conveyor) and conveyor section. Conveyor here is controlled by motor starter mounted on wall and operated from pushbutton station on stud at right. This photo was taken between the outside building wall, at left, and the decorative wall bounding display area, at right. Circuiting of power and control circuits for motor is done with NM cable.

ESTIMATING FORUM—I

Operating Costs — Principal Cost Divisions of an Estimate

By **Ray Ashley,** *Research and Consulting Engineer, Oak Park, Ill.*

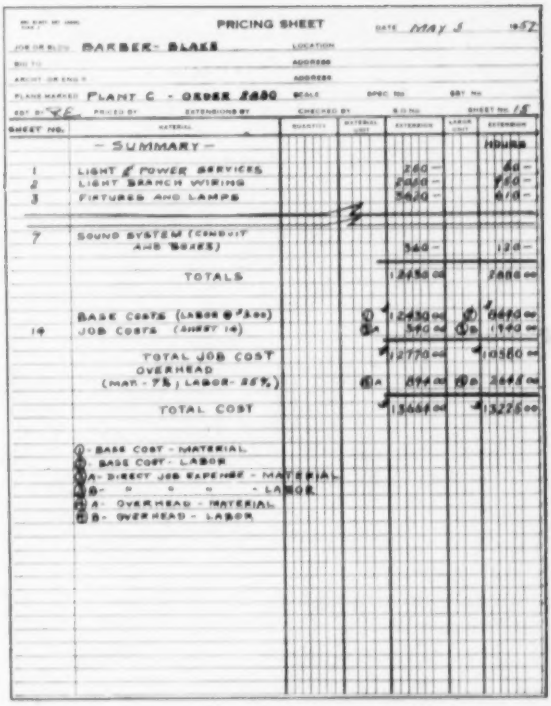
QUESTION:

What are the four principal divisions of costs that must be included in an estimate?

ANSWER:

The prime cost divisions of an electrical estimate are as follows:

1. ***Material base cost—purchase price***
2. ***Labor base cost—payroll***
3. ***Direct job costs (or direct job expense)***
4. ***Overhead***



PRICING SHEET

DATE MAY 5 1957

JOB OR BLDG. BARBER- BLAKE LOCATION

PLANS MARKED PLANT C - ORDER 2480 SCALE SPEC. NO. QST. NO.

EST. BY TC PRICED BY EXTENSIONS BY CHECKED BY SHEET NO. 15

SHEET NO.	MATERIAL	QUANTITY	MATERIAL COST	MATERIAL EXTENSION	LABOR COST	LABOR EXTENSION
	— SUMMARY —					HOURS
1	LIGHT & POWER SERVICES			260 —		26 —
2	LIGHT BRANCH WIRING			7460 —		760 —
3	FIXTURES AND LAMPS			3630 —		610 —
7	SOUND SYSTEM (CONDUIT AND BOXES)			360 —		120 —
	TOTALS			12450 00		7886 00
	BASE COSTS (LABOR @ 7.80)			① 12450 00		③ 6494 00
14	JOB COSTS (SHEET 14)			②A 360 00		③B 1392 00
	TOTAL JOB COST			12770 00		10580 00
	OVERHEAD (MAT - 75% LABOR - 25%)			④A 894 00		④B 2648 00
	TOTAL COST			13664 00		13228 00

① - BASE COST - MATERIAL
② - BASE COST - LABOR
③A - DIRECT JOB EXPENSE - MATERIAL
③B - " " " - LABOR
④A - OVERHEAD - MATERIAL
④B - OVERHEAD - LABOR

FIG. 1—Estimate summary clearly lists the four principal cost divisions (1, 2, 3, 4) that make up a complete accurate estimate. To this total cost must be added a percentage for "return" to establish a bid price.

DISCUSSION:

The first two items, material and labor, constitute the major costs. However, for accurate estimating, the latter two must be carefully figured.

In a vast number of estimates, errors in figuring job costs and overhead are greater than those found in the estimated costs of material and labor. Basically, this is because it is an easier task to establish costs of material and labor than it is to learn what constitutes direct job costs and overhead.

At one time, many contractors had the mistaken idea that all costs, over and above base material and labor cost, could be included in one markup called "overhead." Time and experience have established the fallacy of this thinking. The accurate and comprehensive cost estimate should include the four categories listed in the above answer and shown in the recap sheet of Fig. 1. This establishes the contractor's estimated cost for the project. A percentage for "return" should be added to arrive at a "bid price."

In discussing the next question in this series, we will learn why true overhead does not embrace all operating costs.

PLACEMENT OF BRACKETS for lamp sockets and ballasts was facilitated through use of sliding platform erected on top of contractor's truck. Since platform could be projected from either side, truck could proceed through tunnel in straight line, without crossing lanes, while men working aloft completed their assignments.

INSTALLATION TECHNIQUES

. . . related to Lincoln Tunnel electrification

Special scaffolds, trucks, diamond drills and power tools were extensively used by electrical contractors on this $100-million expansion and modernization project.

By Winfield Rose, *Project Supervisor, Lightning Electric Service Co., Newark, N. J.*

ON VERY large projects, where many installation operations are repeated over and over again, even modest reductions in the time or effort required per operation can contribute to impressive overall efficiency standards. This was certainly true during the electrification of the Third Tube of the Lincoln Tunnel, for repetitive operations were required for such mass-installation assignments as installing over three miles of continuous fluorescent lighting within the tunnel proper; installing roadway signals, lighting standards and illuminated signs for an additional three miles of approach roadways; pulling-in over a million feet of neoprene-jacketed wire and cable; and wiring a vast network of telephone, fire alarm, carbon monoxide, code-call and traffic control systems.

Realizing that these sizable wiring components offered an opportunity to obtain major benefits from even minor improvements in efficiency, we gave considerable thought to the use of modern power tools; the modification of standard equipment to our specific requirements; and to the development of practical installation methods. Some of these methods were so obvious, so simple or so logical that it is surprising they are not practiced more extensively.

For example, in order to erect lighting standards along busy tunnel approaches without unduly obstructing traffic, the boom of an erection truck was offset (all legs being of different lengths) so that the boom projected at an angle to the side, instead of pointing di-

rectly to the rear of the truck. With this arrangement, the truck could remain constantly in the outer lane of traffic, moving directly forward, as standards were progressively raised and positioned. Since the truck did not have to "saw" back and forth across several lanes in order to get into exact position, all lanes except the outer one were kept open for "traffic as usual" and this installation sequence was greatly speeded up as a result.

Another installation method concerned the placement of lighting brackets, fixtures and ballasts within the tunnel itself. This work was performed, for the most part, from special platforms installed atop telephone-type trucks. The platforms consisted of ¾-in. exterior plywood in angle iron frames, frames being supported by grooved and lipped cradles that permitted the platforms to be projected outwards from either side of the truck body, as desired. With this arrangement, trucks could proceed forward through the tunnel in the most convenient direction, reversing their direction or weaving from lane to lane was again unnecessary; and, by projecting the work platform to the desired side of the truck, electricians working aloft could stand upon a firm, safe (railing guarded) base at all times.

Installation of lighting fixtures was further simplified by the extensive use of compression connectors designed originally for utility distribution systems. This practice was dictated partially by voltage and space considerations, for, with lighting feeders carrying 1200 volts and with lamp socket and ballast housings designed compactly, it was apparent that taps and connections should minimize bulk wherever possible in order to insure positive insulation between cables and metal enclosures.

For that reason it was decided to use crimped taps and connectors rather than split-bolt mechanical connectors or conventional solder-and-tape splices. As a result, we used crimped compression connectors when working with No. 6 feeders and No. 12 taps, and we used post connectors having compression lugs when grounding socket boxes with No. 10 cables. In these instances we used manually powered crimping tools but, when splicing larger-sized cables (as was necessary for approach feeders and branches), we used hydraulic tools that developed a compression force of approximately 9 tons. In addition to these instances, we also used pressure connectors in connection with the wiring of 200-hp ventilation fan motors; also the wiring of utility outlets (for serving vacuum cleaners) within the exhaust ducts. Use of these tools and devices reduced the bulk of the connections considerably. And quite gratifyingly, it also speeded the installation and resulted in tangible dollar savings.

VERTICAL LIFT hydraulic-powered platform was also used by contractors during installation of luminaires and lamps atop tapered double-arm standards along approachways to tunnel.

DIAMOND CORE drill, mounted on top of truck, has manually operated jack that exerts upward pressure on cutting edges; hand-operated pressure pump to direct water to cutting area for cooling and washing purposes; funnel to catch chips and return water.

Getting back to the subject of mobile rigs, it may also be mentioned that we used a truck-mounted manually operated diamond-core drill to cut through already-placed tiling on tunnel ceiling panels. This operation was in connection with the installation of special enclosures containing traffic signal lights.

In order to maintain a constant and steady upward thrust on the cutting edge of the drill, a manually-operated jack was used. And, to keep cutting edges cool and lubricated, a hand-operated pressure pump was likewise installed atop the truck, with a hose connection carrying water directly to the drilling area. This pressurized jet also kept the working area clean, for it constantly flushed tile chips, concrete particles and dust away from the surface being drilled. The debris so flushed was caught by a funnel arrangement equipped with a strainer, thereby permitting screened water to return to the pressure tank for repumping and redirection to subsequent work areas. As a result of this method, cutting was accurate, fast and sharp; arm fatigue of workers was minimized; surfaces cut by this means were kept and left clean, and water was salvaged and re-used so that interruptions, required to refill the pressure tank, were minimized.

Mobile units played yet another important role in this tunnel installation, for specially equipped

LARGE TRAILERS, fitted with inclined drafting tables, blueprint racks, desks and storage bins, and with full facilities for high-level illumination, heat, cooking and telephone service, were used by contractors on the job as mobile field offices.

OFFSET BOOM on truck permits setting of lighting standards without blocking more than a single lane of traffic. Electrical contract for Lincoln Tunnel included lighting, signs, traffic signals and communications facilities for 5 miles of approaches.

trailers were used as field offices. These trailers were fitted with inclined drafting tables, desks, drawing racks and storage bins, with lighting units located above all work areas to provide high-level illumination for the drafting or study of plans.

Since most of these trailers were observed by thousands of commuters daily (travelling between Manhattan and Jersey by buses or cars using the two previously-completed tubes), and since trailers were distinctively painted and plainly identified by the names of the two joint-venture contractors (Fischbach & Moore, and Lightning Electric Service), these vehicles no doubt contributed additional benefits related to advertising and prestige.

In connection with these trailer offices, a word should be included concerning our installation-period communication system, for all trailers were connected to local telephone switchboards, making it possible to quickly trace supervisory personnel, contact either "home" office (Lightning in Newark, N. J., or Fischbach & Moore in New York City), discuss plans and specifications with the Port Authority engineering department, place orders for material or verify delivery schedules.

Two separate mediums for communicating with personnel within the tunnel itself were also available. The first medium was by regular "outside" telephone service lines (connecting field offices and power houses with compression headings and locks via air-shaft circuiting), and the second medium consisted of battery-operated phone systems (having auxiliary hand-crank power provisions) that linked field offices directly with underwater work centers.

It may also be of interest to discuss several methods used by the Port Authority to keep constantly advised as to the status of all contracts involved on this extensive $100-million 6-year construction project. Accurate tabulations and records were imperative for, without them, confusion could easily have resulted. Including all trades and all phases of the work, contracts numbered over 50 and, since these various contracts repeatedly overlapped or ran concurrently, minute planning was necessary to dovetail activities, insure prompt delivery of materials (to keep progress uninterrupted, yet minimize the necessity for lengthy storage) and coordinate installation details.

The first method used for this purpose was a bar-chart construction schedule listing all contract numbers, brief descriptions of their scopes, estimated engineering and construction costs, notations of dates (when contracts were awarded, and when various areas were required for construction or installation), plus variously shaded or outlined bar areas indicating design periods (prior to solicitation of bids), fabrication and delivery of equipment and materials, and estimated total extent of the contract periods, with week-by-week progress likewise indicated.

The second method was a conventional construction-schedule graph, the abscissa being time (in months), and the ordinate being percentage of completion. This graph indicated the construction schedule as initially planned, as contrasted to the schedule as actually achieved. Since it considered

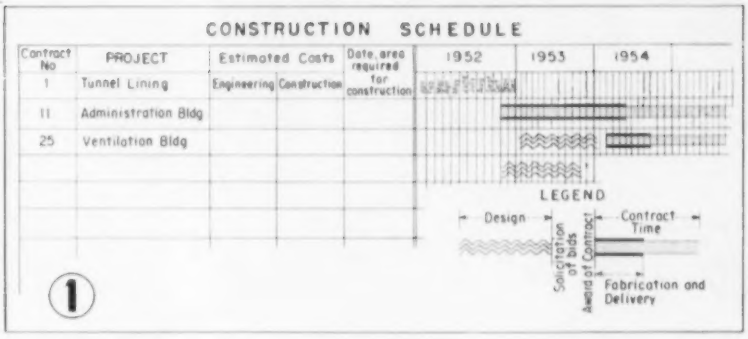
the entire tunnel project as a single entity, however, it could not possibly indicate the status of each separate contract (such as, specifically, the electrical work).

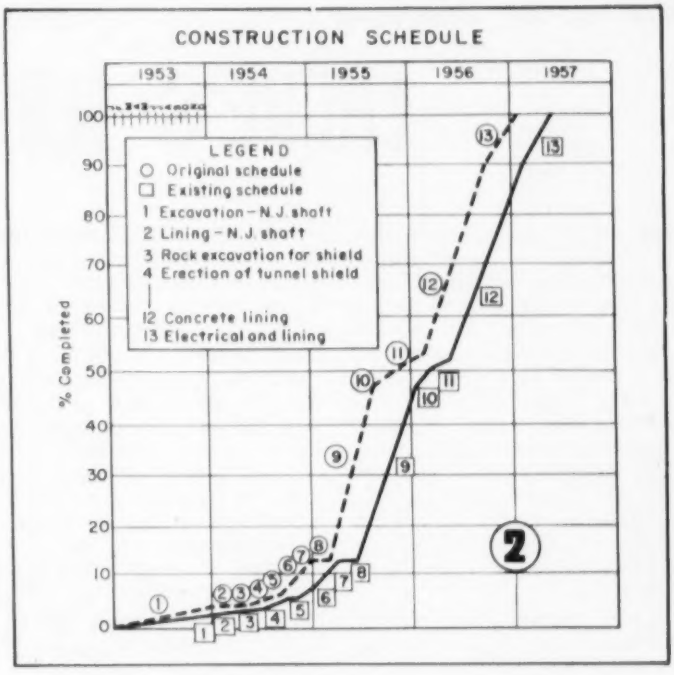
For that reason, another bar-chart method was developed breaking the total electrical contract down into components and visually indicating how these electrical components would have to be coordinated with work being performed under related contracts.

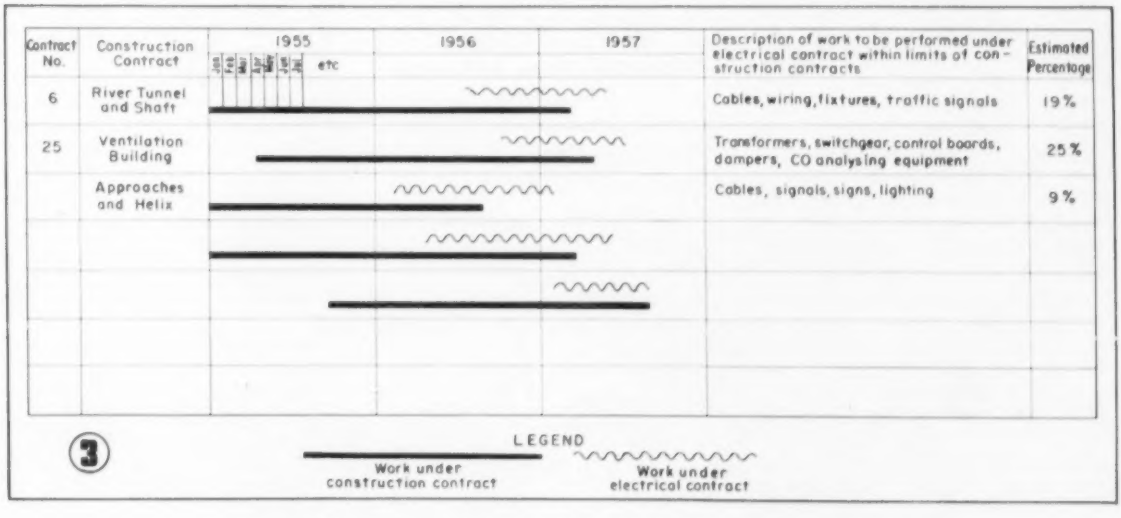
This chart was most useful in scheduling work and planning details of coordination with other contracting organizations. And the chart was of additional interest, inasmuch as it indicated what *percentage* of the total electrical contract (in dollar value) was related to the various components (1) and areas (2) of work involved.

Throughout the duration of the installation period we consistently used power hoists, truck winches, numerous power tools, plus a variety of production-line mass-assembly and installation techniques.

CONSTRUCTION SCHEDULES on this $100-million project were of three different types: (1) a bar-chart, showing brief description of various contracts together with their design, delivery and installation statuses; (2) a conventional graph, showing percentage of work scheduled and actually installed; and (3) one directly relating electrical contract to construction contracts overlapped by it. This latter type visually reminded supervisors and foremen of necessity for coordination with other trades; also indicated percentage of total electrical contract that each component represented.







ORIGINAL LIGHTING in the high-ceiling interior provided about 18 footcandles of uncomfortable illumination. Plaster ceiling reverberated business machine clatter.

Contractor Discovers

THERE'S NO CEILING ON

COMPLETE ceiling installations, particularly in the commercial relighting and remodeling field, are opening a profitable new market for the electrical contractor. Recent refinements in over-all suspended ceiling design and construction have made it possible for the electrical contractor to sell and install a "complete ceiling package" including supporting gridwork, lighting panels, acoustic panels, fixtures and wiring. No longer is his work confined to mounting fixtures and circuits in a suspended ceiling installed by others.

The new concept offers several advantages. The customer pays considerably less for the combination ceiling and lighting system than for a comparable ceiling and fixture installation involving several trades. Less "muss and fuss" results from an integrated ceiling installation and work can be done during normal hours without serious inconvenience to customer operations. Over-all installation efficiency goes up since one group of mechanics under single supervision does the complete job. Construction delays, inherent when several trades work on the same project, are eliminated since the electrical contractor has complete control of men and materials. Over-all volume per job is up and so is the electrical contractor's net return.

This has been the experience of Sweney Electric Co., Inc., enterprising electrical contracting and engineering firm in Gary, Ind. It all started a few years ago when the Sweney organization designed, sold and installed a luminous ceiling system for an automobile showroom. One satisfied customer who saved money was all that was necessary. A trend was established and it is snowballing in the Gary area. To date, Sweney Electric has enjoyed some $100,000 of "unsolicited" ceiling business and more is on the books. Past installations include such diverse enterprises as automobile agencies, shoe stores, furniture stores, engineering offices, a night club and a bank (which will be described here).

Customers come to Sweney Electric and ask for integrated ceiling jobs like ones they've seen. Some have been referred by general contractors who frankly admit that an electrical contractor can do a better job with the new ceiling systems at less cost. But, that's not all. A number of installations have led to extra work. The night club owner was so pleased with the acoustic qualities of the new integrated ceiling that he had Sweney Electric install a "hi-fi" system that cost almost 40% of the original electrical contract.

Manhour Breakdown
4,000-Sq Ft Ceiling Installation
For a Bank

Installation Category	*Manhours*
Sub-feeder and Lighting Panel	40
Branch Circuit Wiring	24
Hanging Fluorescent Fixtures (140)	128
Assembling and Installing 300-watt Incandescent Fixtures (40)	60
Installing Ceiling Grid Hardware and Panels	712
	964
Supervision	50
Total Manhours	1,014

Bank Goes Modern

Typical of integrated ceiling installations is the Silvray ceiling recently installed in the Gary Trust & Savings Bank. The complete ceiling was engineered, sold, and installed by the Sweney organization. Work was done during regular hours without interrupting banking operations.

Original lighting consisted of incandescent, enclosing-globe fixtures suspended from the 18-ft ceiling. Business machine noise and the sound of footsteps on the tile floors reverberated from the plaster ceiling. Average lighting intensity was about 18 footcandles. The ultimate goal was to increase the lighting level and decrease the noise level.

These highly unsatisfactory working conditions were eliminated by the new 4,000 sq-ft ceiling having some 66% of its area in acoustic material and the rest lighting panels. Placement of acoustic and translucent panels resulted in an

NEW INTEGRATED CEILING combines 50 footcandles maintained light-intensity with effective acoustic treatment, adds modern touch to bank interior.

CEILING WORK

By Robert E. Walton, *Vice President*
Sweney Electric Co., Inc., Gary, Ind.

. . . when integrated acoustic and luminous ceilings are handled as a complete electrical installation. New concept cuts customer's installation costs while boosting contractor's return.

interesting rectangular design which blended well with the structural lines and decor of the bank interior.

Both incandescent and fluorescent fixtures were used. A total of 40 300-watt silver-bowl incandescent units (each 4-ft square with eggcrate metal louvers) were spotted throughout the ceiling. These were supplemented by a total of 136 40-watt and four 20-watt, single-lamp, fluorescent RLM fixtures mounted above the translucent ceiling panels.

Installation followed a well-ordered, uninterrupted sequence. First, a new subfeeder and lighting distribution panel were installed. The existing service was adequate to take the new load. At the same time, air conditioning ducts and equipment were installed under a sub-contract. Branch circuits and fluorescent fixture installation and lamping followed.

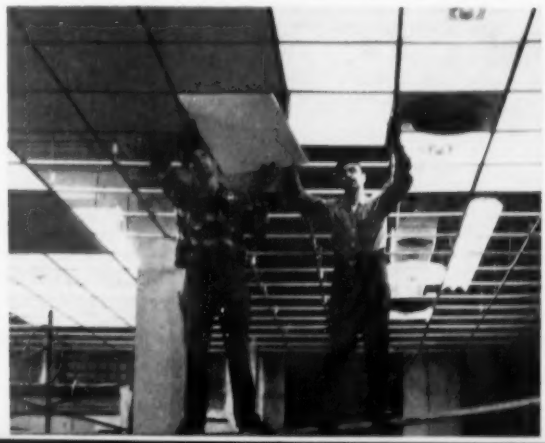
Then the electricians installed the ceiling gridwork. This consisted of an assembly of inverted, aluminum T-bars forming a 4-ft square grid pattern some 32 in. below existing ceiling level. The incandescent fixtures, with louvers, were mounted to the grid as were the air conditioning outlets. Final operations involved setting the 4-ft by 4-ft translucent plastic panels and acoustic panels in the grid frames.

Electrical manhours devoted to the complete integrated ceiling, including supervision, totaled 1,014. Of this, better than 70% was spent on the ceiling grid and panel installation—ample justification for an electrical contractor's interest in this type of work.

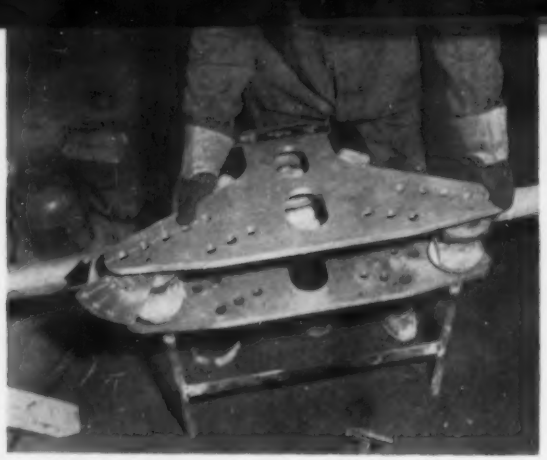
When completed, this $20,000 ceiling installation provided bank personnel with an average maintained intensity of 50 footcandles of glarefree illumination on the working plane. In addition, it cut noise to a fraction of the original level.

COMPLETE CEILING GRID was installed by electricians. Inverted, aluminum T-bars form 4-ft squares to seat incandescent fixtures (left) and ceiling panels. Air conditioning was installed under sub-contract.

CEILING PANELS are installed by electricians. Lighting panels are of metal-framed translucent plastic. Acoustic panels are of Celotex. Both can be easily removed for maintenance or installation of other systems in plenum.



HYDRAULIC BENDER used on project was of light-weight construction (aluminum frame and shoes) and equipped with easy-to-read angle gauge and motorized hydraulic pump. Hand pump can also be used with unit.



PORTABLE STAND keeps bender some 30 in. off floor at finger-tip height helps boost operator efficiency. Note integral gauge (arrow) which indicates progressive bend angle. Slide clamp secures aluminum top-plate to ram housing.

It Pays To Field-Bend Conduit

Electrical contractor saved several thousand dollars by using lightweight, one-shot, hydraulic bender for field-bending conduit on hospital project.

By William Stoiber, *Field Engineer*
Dietz Electric Co., Inc., Milwaukee, Wis.

BIG electrical construction projects are no novelty for Dietz Electric Co., versatile Milwaukee electrical contracting firm. Even the new $8 million St. Michael's hospital project was taken in stride. Standard procedure on such jobs is to supplement a well-organized field operation with enough of the right type of tools to substantially cut installation costs. Included in this category are power cutting and threading machines, power drills and hydraulic conduit benders. Even the addition of a 20-ft table in the field office made it easier for the mechanics and field engineers to check some 200 separate drawings for the project.

Ever alert to the latest developments in labor-saving equipment, Dietz engineers used this installation to field-test the new lightweight, one-shot, Blackhawk 4-in. hydraulic conduit bender. Following the established practice, Dietz mechanics made more than 700 field bends in some 190,000 ft of conduit installed throughout the building. The bender, with both hand and motorized hydraulic pump, was used on conduit ranging from 1¼-in. through 4-in. size. In general, the motorized pump was used on the larger conduit bent before installation, the hand pump on conduits requiring offsets after installation in overhead racks.

Savings Effected

To establish the economics and full advantages of field bending, actual cost records were maintained throughout the project. Costs per bend, including cost of conduit and labor for bending, layout and installation, were noted for all sizes of conduit formed on the motorized hydraulic bender. Similar costs for installation of manufactured elbows, including cost of elbow and extra coupling plus labor for layout, measuring, cutting and threading conduit and installation, were estimated for comparative purposes.

For example: the cost of installing a 3-in. manufactured 90-degree conduit elbow is $14.76. Actual cost of field-bending 3-in. conduit and installing the resultant 90-degree section came to $4.27, or a saving of $10.49 per bend. Savings are proportionate for other conduit sizes—the larger the conduit, the greater the savings.

Comparative Installation Costs
Manufactured Elbows Versus Field Bending of Conduit

Conduit Size	INSTALLATION COSTS—Dollars						SAVINGS THROUGH FIELD BENDING—Dollars		
	Manufactured Elbows			Field Bending					
	Elbow and Coupling	Labor	Total	Material	Labor	Total	Per Elbow	No. of Bends	Total Savings
2"	$2.05	$4.68	$6.73	$0.88	$1.44	$2.32	$4.41	50	$220.50
2½"	3.78	6.37	10.15	1.65	1.80	3.45	6.70	123	824.10
3"	6.34	8.42	14.76	2.25	2.02	4.27	10.49	60	629.40
3½"	11.39	10.37	21.76	3.05	2.56	5.61	16.15	40	646.00
							Total Savings		**$2,320.00**

ONE-SHOT BEND produces a 90-degree offset in a length of 2½-in. conduit. Light-weight top-plate can be easily removed to take out conduit. Wax spray on bent portion of conduit prevents shoe sticking.

BENT TO FIT job conditions is this length of heavy steel conduit. Mechanic is checking critical offset dimension before releasing it for installation. This section of conduit illustrates a run impossible to accomplish with manufactured elbows.

The economies effected by field-bending more than 270 90-degree offset in conduit ranging from 2-in. through 3½-in. size are shown in the comparative cost table at left. This group alone accounted for more than $2,300 in savings. Of this, approximately 61% was labor; 39% material.

Use Bender Stand

A combination of factors contributed substantially to the field-bending efficiency on this project. One of these was the portable pipe stand we designed to keep the hydraulic bender at a convenient working height some 30 in. above floor level. This facilitated bender setup and adjustment, insertion and extraction of conduit, and the necessary measurements. By having the work at finger-tip height, electricians were able to make bends faster and more accurately.

The "one-shot" feature for bending 90-degree offsets plus the use of the electric hydraulic pump saved considerable time. The former eliminates the old multi-step method involving "inching" the conduit along after each short-ram travel to get the desired offset. One operation of the ram now produces a 90-degree bend. The latter lets horsepower take over for muscle power. In fact, comparative tests with the hand and motorized hydraulic pumps proved that bends on 3-in. and 4-in. conduit can be made up to three times faster with the electric pump.

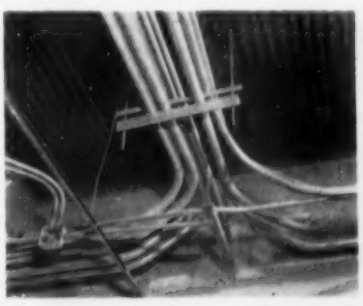
Angle Gauge Helps

The "Optik Angle" gauge on the bender we used was another time saver. This handy accessory provides the electrician with a constant indication of degree of bend during ram travel. It eliminates possible guessing, which is often wrong, and considerable measuring, which is always time-consuming.

The gauge was particularly useful in controlling normal "spring-back" in steel conduit. By watching the gauge, the electrician could allow for such spring-back by over-bending say two or three degrees and hit the desired offset angle every time. Not only does this save time, but reduces to a minimum conduit wasted because of incorrect bends. The advantage for production-type field bending is obvious, since the extra power available could easily cause overheating if not constantly observed.

Use Wax Spray

Another innovation was the experimental use of a specially developed wax spray to aid removal of the conduit from the bender shoe. A little wax was sprayed on that portion of the conduit to be bent.



FIELD-BENDS in this trapeze-supported group of conduits provide wide-sweep offsets that facilitate conductor installation.

After the bend was completed, the conduit was easily dislodged from the bending shoe without the difficulty normally encountered when conduit and shoe "stick" together. This can be especially helpful for overhead bending of a racked conduit run.

Overhead Bending

Another big advantage on this project was the lightweight construction of the hydraulic bender used. All bending frames and shoes were of one-piece aluminum. The unit was easy to move from place to place throughout the building and could, where necessary, be used for overhead bending of conduit.

An electrician could easily carry the bender up a ladder, assemble it on the overhead conduit and, with the portable hydraulic hand pump, bend the conduit to any desired angle. Because we could bend overhead so easily, we were not forced to use manufactured elbows, unions and other types of fittings for such conditions. Add to this the time necessary to cut and thread conduit sections and assemble these components and you can visualize the savings possible and the contribution to reducing overall construction time.

From an over-all standpoint, field-bending of conduit paid off on this project, as it has on others. The combination of a light-weight hydraulic bender with motorized and portable hand pump helped get the job done on schedule and at considerable savings. Also, it permitted our mechanics to perform many different types of operations that heretofore were impossible or impracticable from an economic angle.

NEW LIGHTING ADDS SPARKLE TO CATHEDRAL MOSAICS

Sachs Electric Corporation installs $260,000 lighting system to enhance famed interior beauty of the St. Louis Cathedral in St. Louis, Mo. Unique 36-8-kw dome fixture highlights mosaics; illuminates seating area; operates on remote dimmer control.

SANCTUARY INTERIOR now sparkles with the beauty of magnificent mosaics and statuary accented by the new lighting system.

A NEW, $260,000 lighting installation is refocusing visual attention to the world-famed artistic beauty of the St. Louis Cathedral. Within this magnificent Byzantine-style structure are found more than $2 million worth of mosaics, delicately carved statuary, sculptured marble and numerous other examples of master craftsmanship rivaling that in such other old-world churches as St. Peter's in Rome, Santa Sophia in Constantinople, and St. Mark's in Venice. Yet, through the years, much of the splendor of this ornamentation has been hidden from congregation and visitors by a pallor created by inadequate lighting.

Now, with the illumination project nearing completion, new life is being added to the true magnificence of the Cathedral interior. Many of the 150 million pieces of jewel-like glass and stone comprising the wall and dome mosaics are again sparkling with rare beauty.

Working within the designs of Maguolo and Quick, architects and engineers, Sachs Electric Corporation of St. Louis installed the specially designed fixtures and electrical system components so that all lighting can be controlled from a master panel in the Priest's Sacristy at the rear of the Cathedral. Six 12-position selector switches and two remote control dimmers permit hundreds of different lighting effects.

36.8-KW Center Dome Fixture

Of the entire project, one of the most difficult and unusual operations faced by Sach's engineers and electricians was the installation of a 36.8-kw, 3,000-lb, multi-lamp fixture assembly in the main Cathedral dome some 143 ft above the main floor. The unit, manufactured by the Rambusch Decorating Co., New York, and considered the largest of its kind in the world, is mounted in the oculus of the main dome and rests on top of dome's compression ring (Fig. 1). It illuminates about 11,700 sq ft of main floor and seating area and highlights the mosaic surface of the dome itself.

The multi-lamp fixture consists of 96 sealed-beam projector lamps, each having a 300-watt capacity. In a ring around the base of the unit are mounted eight 1,000-watt shovel lights that illuminate the dome mosaics. Two fans, built into the unit, dissipate heat from

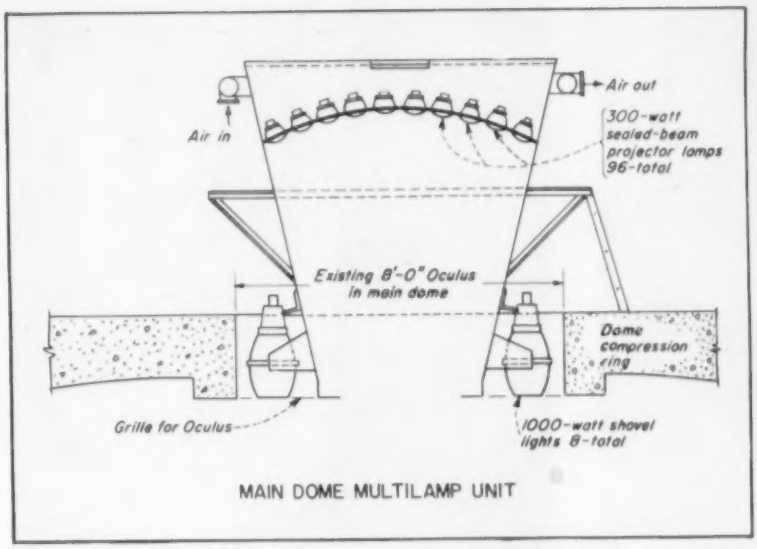
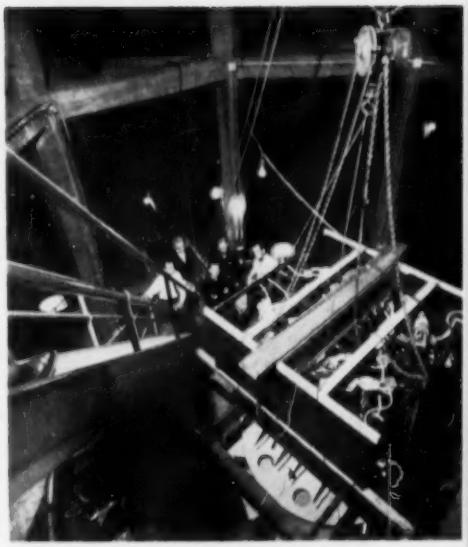


FIG. 1—Section through main dome multi-lamp 36.8-kw fixture showing position of light-source components. 3,000-lb unit rests on dome compression ring. Bottom of fixture is flush with dome oculus.



MULTI-LAMP FIXTURE in main dome of Cathedral is suspended by chain block and supported by steel horses over covered oculus during assembly. Space is between inner and outer shell of Cathedral dome.

the lamps. An interlocking safety control automatically cuts off the lighting in case of fan failure or overloading of the assembly. Two remote-control dimmers operate the fixture. One controls two-thirds of the lamps in the main dome unit. The other dimmer controls one-third of the main unit lamps plus the fixtures in the south dome of the Cathedral.

Mounting of this massive fixture presented an interesting study in intallation techniques. Sachs' crews brought the disassembled unit up over the Cathedral roof by means of a boom, then carried it up some 75 steps to the dome ceiling. These stairs are in a 60-ft space between the inner and outer shells of the main dome. All wiring, as well as the dimmer board, are concealed in this space.

The fixture was assembled on iron horses 30 in. above the floor recess formed by the dome compression ring. The 8-ft diameter oculus directly below the fixture was covered with a wood closure. When assembly was completed, the 3,000-lb fixture was raised by chain block, the horses and closure removed, and the unit lowered into position in the oculus (opening) of the dome.

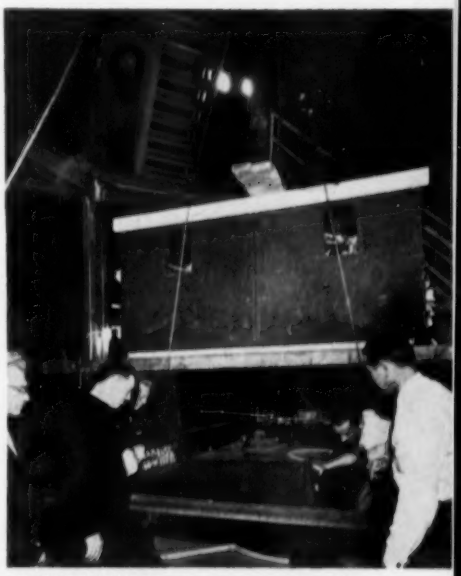
At the corners of the Cathedral are four chapels. In each of these, four torch standards were installed. The chapel altars are softly lighted to provide dramatic accents and to emphasize the surrounding statues and mosaics. Shelf lights installed in the confessionals illuminate the kneeler. As the worshiper kneels, this light is extinguished and a cross on top of confessional lights up to show that it is occupied. Sachs also installed hearing aids to accommodate the hard-of-hearing worshipers.

Floodlights along the transepts and clerestory edge spread illumination across a wide expanse of mosaics. Special lights illuminate the Stations of the Cross to further enhance the beauty of the interior. In the Sanctuary, nine lanterns were placed around the altar and additional lights were used to highlight the center figure of Christ and other statuary. When combined with highlighting on the pulpit and on the Archbishop's throne, these provide a wide variety of interesting effects.

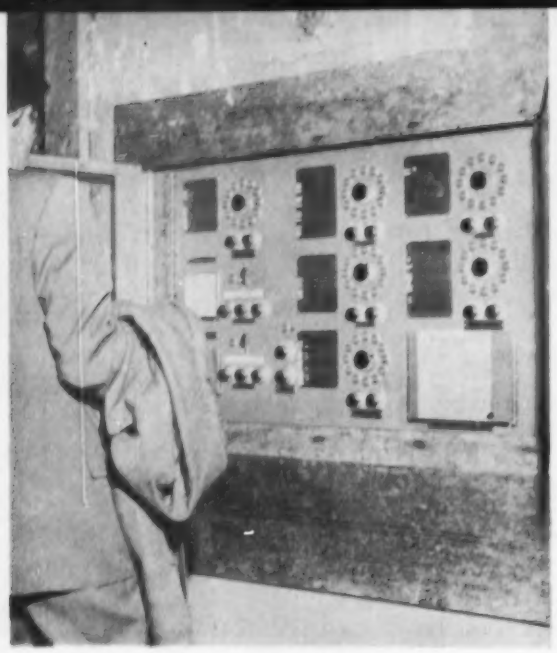
Debris-Free Cutting

Another interesting technique was used for installation of six 1,000-watt "down lights" around the south dome of the Cathedral. These units were set in openings cut into the concrete dome. Holes were cut from above the dome without dropping any debris into the nave.

First, a small hole was drilled through the dome at the desired location. Then a line was dropped through this hole to the floor, approximately 100 ft below, and attached to a box. The line was then drawn up through the hole



SHOVEL LIGHTS are being spotted on the ring at base of the partially assembled main dome fixture. Eight of these 1,000-watt units illuminate the main dome mosaic. Main floor seating area (11,700 sq ft) some 143 ft below is illuminated by 96 300-watt sealed-beam projector lamps in the fixture.



MASTER CONTROL PANEL for all Cathedral lighting is in Priest's Sacristy; contains six 12-position selector switches and two dimmer controls. Louis Sachs, president, Sachs Electric Corp., checks panel after installation.

QUIET RELAY OPERATION is assured by mounting relays and remote control switches on shock-absorbing pads and lining panel interior surfaces with sound-deadening material. Here, Sach's foreman Tom Hartman makes final adjustment.

until the box was securely anchored against the under side of the dome. As the opening was chipped out to desired size, the broken pieces of concrete were caught by the box and the nave below remained clean.

Quiet Relay Panels

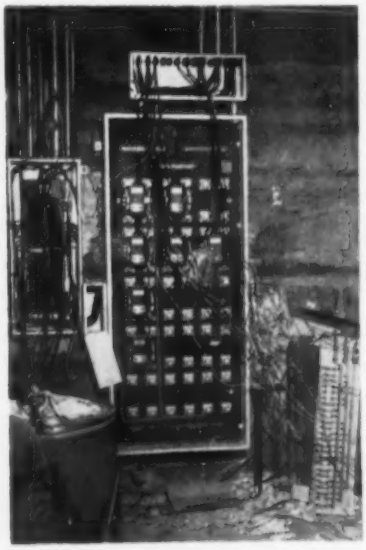
To provide the desired control and illumination flexibility, a number of relay panels were installed between the master control panel and the individual circuits to the lighting units. In general, these consisted of groups of ASCO remote control switches mounted in steel cabinet enclosures.

Quiet operation in this type of an installation was a prerequisite. To deaden any switch or relay noise, two precautions were taken. First, all remote control switches and relays were mounted on shock and sound absorbing pads. Second, all cabinet interior surfaces were covered with a sound-absorbing material. Spare relays have been provided for future additions to the new lighting system.

Main service panels are located in the boiler house west of the Cathedral building. Two services provide all electrical facilities. A 1,200-amp, 120/208-volt, 3-phase, 4-wire service is for lighting. A 400-amp, 240-volt, 3-phase service provides the necessary power requirements.

Feeders run through basement tunnels to reach circuit-breaker type distribution panelboards and relay panels.

CHAPEL ILLUMINATION combines torch standards with softly lighted altars to provide dramatic accents. Here, Father Durkin, Cathedral Administrator, turns lights on in one of four chapels.



ONE OF THE MANY relay panels installed in Cathedral basement to control lighting. Note shock-absorbing pads for mounting remote control switches; also circuit breaker distribution panel at left.

While most of the lighting facilities are installed in the Cathedral interior, special care was taken to see that the exterior was adequately illuminated at night. Sachs' crews set up a battery of strategically placed floodlights plus special 15-ft high light standards. To install circuits to these standards, holes had to be drilled through 3-ft thick granite blocks.

When the entire $1,825,000 restoration program is completed, the St. Louis Cathedral will be one of the largest and most beautiful of its kind in the world. With the new lighting system in operation, the complete beauty of the structure will be truly seen for the first time.

New Ratings for 0 and 1 Starters

New NEMA standards extend ratings for two most-used starter constructions offering potential cost reductions and space savings.

By W. T. Stuart

SIZE 0 and 1 motor starters are uprated to higher application capacities in an important revision of NEMA standards. The new ratings for the two sizes cover approximately 75% of present integral hp motor applications in industry.

Several leading manufacturers of electric control apparatus will announce products carrying the new nameplate ratings during the third quarter of this year and it is expected that the new ratings will be in general use before the end of the year.

NEMA standard ratings for starters used with 1- to 200-hp motors have been unchanged since 1937. Modern equipment design trends have created pressure for re-evaluation of motor starters in three areas: first, for each motor applied, hp ratings are increasing; second, whereas formerly one or two large motors were used and on a machine mechanical power take-offs such as belts, drives, and transmissions were used to perform operating functions in several locations in the equipment, now more and more individual motors in the 1- to 10-hp range are applied to give independent control of non-connected operating functions; and third, as a result of the increased number of motors being used per machine, the increasing space occupied by the controls has become a critical factor which in turn demanded smaller starters.

These forces have resulted in an industry-wide re-evaluation which, after three years, has resulted in the uprating of the NEMA size 0 and 1 used in the 1- to 10-hp class. Although only two sizes have been uprated, more than three-quarters of the motors used today fall within this range. The old and new ratings of this revision of NEMA Standards for Industrial Control, part 21, paragraphs 1C 1-21.01, 21.02, and 21.03, are shown in Table I. Whereas 8-hr current ratings for open starters were formerly included, they have now been dropped, and only the enclosed-starter continuous ratings are now used.

This uprating has been made possible by the continued universal improvement in design and materials which have occurred since the previous ratings were established 20 years ago. These improvements have been particularly significant in the areas of hot and cold molded contact housing and support materials, in contact material and design, in reduction, in contact arcing, and in newer methods used to close higher currents and carry them continuously without freezing.

Starters affected by the change are of the across-the-line, full-voltage type used for starting duty only. For starters used for plugging or jogging duty retain the old ratings. The relationship of the re-rated starters to the full line of NEMA starter ratings for fractional hp to 200 hp are shown in Fig. 1 for 220- and 440-volt 3-phase starters.

Cost savings, based on list prices of 3-pole open starters, can range from 5%, where size 0 starters now replace size 1, to as high as 43% where the size 1 replaces the size 2.

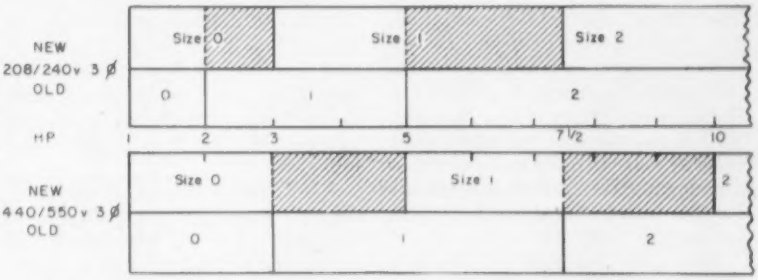


FIG. 1—Increased horsepower carried by rerated three-phase sizes 0 and 1 across-the-line magnetic starters for non-plugging or non-jogging duty. Shaded areas show increase in motor hp capacity produced by rerating.

Table I—Changes Produced by NEMA Rerating of Size 0 and 1 Starters

NEMA Starter Sizes		Motor Horsepower Ratings: Single Phase 115V	230V	440/550V	3 Phase 110V	220V	440/550V	Continuous Current Rating, amp
0	OLD	1	1½	2	1½	2	3	
	NEW	1	2	3	2	3	5	18
1	OLD	1½	3	5	3	5	7½	
	NEW	2	3	5	3	7½	10	27

MAINTENANCE PROCEDURES

. . . related to power system components

PART II

An important maintenance category which is frequently minimized is that of main cables and feeders. Another equally essential classification covers all types of protective relays. Here are some practical reminders for bringing your preventive maintenance program up to date through the inclusion of these essential items.

By Henry E. Heddesheimer, Consultant on Electrical Engineering
Plant Engineering and Maintenance Service, General Electric Co., Schenectady, N. Y.

IN MODERN industrial plants, power cables can rightly be classified as "arteries" that carry "life blood" through electrical distribution systems to production equipment. And, if maximum industrial production (and reasonable profits) are to be assured in this era of increasing automation, this "blood" supply must be dependable and continuous. Cable maintenance, therefore, should not be overlooked, for, if the inclusion of this maintenance procedure eliminates just a single subsequent shutdown, the modest investment in this safety measure will have been amply justified.

Assuming that your maintenance program does not already include cables, the first thing to do is to determine existing conditions of all mains and feeders; visually inspecting them for signs of poor thermal conditions, moisture, mechanical damage and the like, and checking for overloads on various circuits by using a clamp-on ammeter.

Poor thermal conditions (or excessive heating) and moisture are two common "diseases" leading to deterioration and ultimate failure of insulation. Heating may be caused either by external or internal conditions; that is, by the proximity of steam lines, ovens, other cables or other heat-dissipating items, or by prolonged overloading.

Overloading (a definite possibility if rearrangement, modernization or expansion of a system has not been accompanied by frequent load checks) can lead to increased dielectric losses, drying and cracking of insulation. Quite often insulation becomes so dry and brittle that it will crumble at the slightest touch. So, if cables are found in this condition, it is best not to disturb them until replacement cable is on hand. Otherwise prolonged outages become a distinct possibility.

After initial inspection and necessary corrective measures have been taken, a yearly schedule should be set up to include either dc high-potential tests (or megohmmeter checks) of all feeders. Since a megohmmeter costs considerably less than a dc hi-pot set, it is more widely used. It should be remembered, however, that it is quite often necessary to operate this instrument continuously for a considerable period (up to 10 minutes) before an accurate reading is maintained, so it is strongly recommended that an electronic or motor-driven unit be used.

Acceptable megohm values vary with type and thickness of insulation, also with types of terminators, so these items should be noted when testing. Records should also include notations of all connections, the instrument being used, temperature, date, the operator making the test, and all additional data which would guarantee an exact duplication of test procedure at subsequent dates. An initial group of readings (taken by themselves) means little, except to indicate values which are either "quite high" (for good cables) or zero (on failed conductors). That is why multiple readings at intervals are recommended, and these readings should be taken after 15 and 30 seconds; after 1-, 3-, 5- and 10-minute intervals; until no further increases in megohmmeter values are observed (but no longer than 10 minutes).

Correcting megohmmeter readings to a base temperature is also most important, since the temperature coefficient of electrical insulation is negative and numerically large. In this connection, the Insulated Power Conductor Engineers of America has established a base of 15.5 degrees C, and this organization has published a chart containing multiplication factors which will correct readings for this base.

These corrected readings should then be plotted on semi-log paper, along with all previous readings taken on the particular cable under test. These readings will then indicate any trend that is developing. Record cards are available from manufacturers of megohmmeter equipment, or you can easily design your own. Such cards have a semi-log graph on one side, and appropriate data columns on the other.

If, after several annual or semi-annual checks, it is noted that corrected megohm values are decreasing, more frequent checks should be made on the cable in question. These checks will enable you to establish a rate of deterioration for the insulation and to schedule a shutdown period for the indicated replacement. The alternative, of course, is to wait until the cable fails, then be forced to replace the defective conductor on an emergency basis.

In cases where sufficient time has not elapsed to collect sufficient data to establish a trend, a quick approximate method for evaluating megohm readings can be used. This makes use of what is known as the "polarization index" or "dielectric absorption" ratio; that is, the relation of the 10-minute reading to the 1-minute value. If this ratio is less than 1.2, there is good reason to suspect impending trouble, and the cable should then be checked with frequent regularity to determine the insulation deterioration rate.

Incidentally, it is a practical policy to include *spare* cable reels in this program also, for cables in stock can absorb moisture or can suffer mechanical damage even when not in use. Investing in spare cables is a wise precaution, yet it can be embarrassing as well as costly to discover (when a spare cable is finally placed in service) that it has deteriorated while being held in stock.

Protective Relays

Another important link in the preventive maintenance chain pertains to protective relays. The importance of these items should be stressed, and all maintenance related to them should be both periodic and systematic in nature.

As the name implies, the purpose of a protective relay is to protect an electric system, by functioning properly to preclude extensive damage in the event of abnormal operating conditions. Having a relay which does not perform its intended function (due to inadequate maintenance or improper settings) is worse than not having any relay at all, for the complete absence of a relay would at least eliminate the false feeling of security which would otherwise exist.

Except where operation is frequent or dirt is excessive, inspections and tests of relays should not be necessary more often than once or twice a year. During these inspections, however, the cover should be checked to see that felt gaskets are properly placed; glass should be examined for cracks; connections should be checked for tightness, and the entire assembly should be examined for corrosion or dust accumulation. The relay should be actuated manually to assure free movement of parts, and it should be ascertained that (when actuated) the relay performs its intended function, such as tripping a circuit breaker, energizing an alarm circuit, etc.

If silver contact points are corroded, they should be cleaned with a flexible, etched burnishing tool designed for that purpose. Polishing action should be light in nature so that corrosion can be removed without leaving detrimental scratches or abrasions which might cause future contact trouble.

Quite often an electrical load on a feeder increases gradually, due to greater production requirements, rearrangement of plant equipment or gradual aging of components in the circuit. If relay settings are not increased correspondingly, an overload relay might actuate a breaker during a high load or high production period, causing annoyance, if nothing more. Therefore it is recommended to check actual loads and overload relay settings on a scheduled, periodic basis.

Many plants do not have equipment necessary for complete checking of all relays, and, in these cases, the work should be given to a local service shop. Many utility companies will also cooperate by performing such tests without charge, as a public-relations goodwill gesture. If a charge is involved, however, it is usually nominal and is an investment well worth the modest cost.

Relay calibration should be checked for current and voltage at the pickup, drop-out and several intermediate points and, with the aid of a calibrated resistance or "load box", the current coil of the relay should be loaded to the point where the breaker is actually tripped. This serves the double objective of checking the relay calibration and breaker tripping circuit simultaneously.

Other types of abnormal conditions can also be simulated for test purposes, such as reverse current, over- or under-voltage, ground faults and the like. Testing equipment is available to make all these checks, and notes should be made concerning operation and calibration of relays under these various conditions.

As mentioned in the case of cable maintenance, it is well to also include spare relays in your maintenance schedule so that, in the event of an emergency, time will not be lost in testing a unit at that time, or in installing a defective or improperly calibrated unit. General electrical and mechanical checks, as just described, should suffice for this purpose.

CABLE MAINTENANCE should include scheduled high-potential or megohmmeter checks; visual inspections for signs of moisture, poor thermal conditions or mechanical damage, and, as indicated above, examination of terminal connections of lead cables.

OVERLOAD RELAYS should be checked for indications of dust accumulation, moisture, free movement of parts, cracked covers, gaskets out of place and the like. Except where operation is frequent, inspections and tests should not be required more than once or twice a year.

SHORT SECTIONS of trough and ladders, which might normally be considered as over-matter or waste quantities, can be used with a bit of ingenuity to support cables in close quarters such as in a vault, as indicated in this photo showing the author examining construction details.

Power And Control Wiring

. . . in a Steel Mill

Armored cables, flexible control circuits and various channel-supporting methods provide satisfactory distribution.

By C. A. McGuiness, *Electrical Superintendent*
Allegheny Industrial Electric Co., Inc.

A RECENTLY completed rod and bar mill erected in Atlanta, Ga., by the Atlantic Steel Company, utilizes a combination of interlocked armor power cable supported by ladders, and flexible control circuit wiring contained in cable troughs. Both components of this installation have conserved on the amount of materials used and installation time was also minimized as a result of selecting this distribution combination.

Interlocked armor cable was specified for power requirements due to its higher permissible current air rating (over exposed conduit), while ladders were used as a supporting means because, due to the self-supporting characteristic of the armor cable, only intermittent supporting points were required.

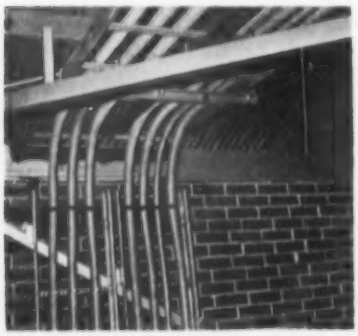
Cable ladders consist of longitudinal side pieces and lateral rungs, with cables secured to rungs by banding. These bands keep cables in orderly array and, when desired, cables may be dropped through ladder rungs at any given point. Since ladder sections could be obtained in various lengths and widths, and numerous fittings were likewise available, changes in direction and elevation could be made without undue field cutting or modification of components. In those cases where field cutting was required, however, adapters were used so that the cut ends could quickly and easily be connected to the succeeding section of ladder.

Control cables, being flexible and not self-supporting, required a supporting medium of a continuous nature, so expanded metal troughs were selected for this purpose. The expanded metal also permitted free circulation of air.

Use of troughs and ladders greatly reduced construction headaches, for even in such normally crowded areas as the motor room (where control wiring is extensive and space is limited), installation work was fast, easy and neat in final appearance. In all, 2½ miles of interlocked armor cable with ladder supports, and nearly 7 miles of control cable were installed.

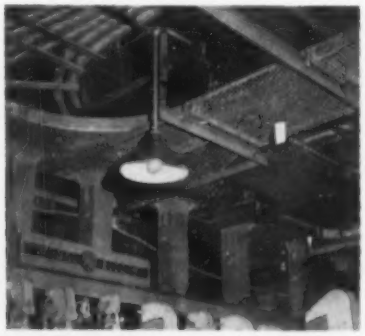
Construction of troughs and ladders alike was of high-strength galvanized steel; connection of sections was by means of steel pins driven through interlocking barrels welded to the sides of the adjacent ladder or trough segments and, since several sections could be assembled at floor level and then raised as a unit into place, installation was correspondingly simplified.

In this distribution system, cable and major items of electrical equipment were furnished by G. E.; cable supports by Cope.



INTERLOCKED ARMOR cable drops between rungs of overhead ladder and is picked up by ladder secured to vertical surface of brick wall. Attachment of cables to ladder rungs is by means of metal bands. Installation permits flexibility for alterations, expansion or inspection of system.

DISTRIBUTION TUNNEL between motor room and section of mill is equipped with tierred expanded-metal troughs along one wall for control wiring, plus surface-mounted overhead U-channel framework for supporting power cables which are secured to same by split clamps and bolts at each cross member.



SQUARE DUCTS atop dc control panels, use of channel iron for trapeze supports, trough arrangements and armored cable on ladders are concentrated in this area where neat appearance and orderly arrangement of circuiting is attained in spite of limited space and extent of wiring.

From Australia—

Special Mounting For Industrial Luminaires

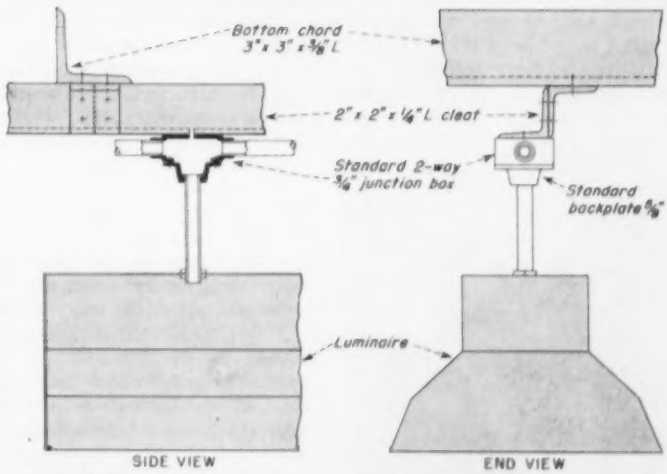
AN UNUSUAL mounting method was used to support luminaires in the "weaving" section at the textile mill of Tootal Broadhurst Lee Co. Ltd., Davenport, Tasmania, Australia. Here, the layout and mounting of the industrial type fluorescent luminaires were designed under the supervision of G. Howard, Chief Engineer.

The lighting system in the weaving section was designed to provide a uniform level of 40 footcandles, with minimum shadows, on some of the world's fastest and most modern looms. To accomplish this objective, the standard industrial reflector units, each housing two 40-watt fluorescent lamps, had to be carefully mounted and spaced. And the problem was complicated by a sawtooth roof construction—with trusses of 22-ft span, spaced 12½ ft on centers, and with the bottom chords mounted 12 ft above the floor. A complete system of air conditioning serviced the area—with air distribution ducts running across the bays just above the bottom chords.

When the lighting units were laid out on paper to obtain mounting positions for the best possible lighting result, it was found necessary to provide special mounting to obtain the desired positioning of the luminaires. The presence of ducts and other obstructions above the chords precluded suspension by hangers from the roof. Instead, the engineers decided to run light angle iron at right angles to the roof trusses—mounted as shown in an accompanying diagram. This method allowed continuous runs the whole width of the area.

Mounting the fixtures to the angle iron was the next step in the suspension problem. For this part of the assembly, two-way, ¾-in. straight-through junction boxes were used. Each box was mounted by screws to the underside of the angle iron at a point of fixture support. A flanged backplate was then fastened to the box and a ⅜-in. hanger was used with locknuts to support the fixture 4 in. below the box.

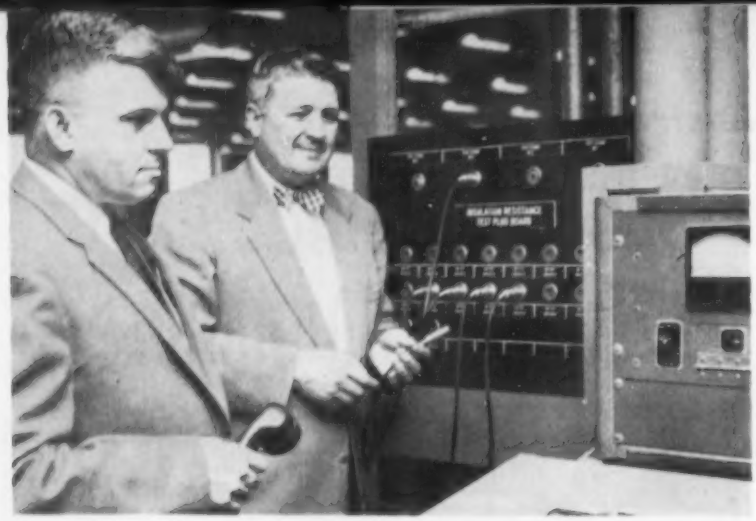
With this method of supporting the fixtures, mass production techniques were readily applied in the fabrication of conduit work. All conduit was cut to exact lengths in a jig and threaded by machine.



CONSTRUCTION DETAILS of the special mounting method.

Each line of conduit was assembled in sections on the floor and then installed. And a simple jig was used to set distances between junction boxes. The rows of conduit assembly were lifted and tied in position while the screw holes were drilled for mounting the junction boxes. After the boxes were bolted in position, normal wiring was carried out.

In the installation described, each line of 13 luminaires is controlled by two switches located in the local lighting panelboard near the main door to the area.



FRANK J. FORSYTH, JR., superintendent of electrical construction, Hatzel & Buehler, Inc., and Thomas J. Burrows, foreman of the electrical department, The Okonite Co., North Brunswick plant, at test console in testing department.

Plant System Changes Serve New Loads

Conversion of auto assembly plant to insulated wire manufacture used basic primary network and lighting with extensive secondary power changes.

ADAPTION of a modern 420,000 sq ft plant in North Brunswick, N. J., planned for auto assembly to insulated wire manufacture involved a major electrical system remodeling project. Originally built for Studebaker, but never occupied, the plant was fully wired and lighted. It was acquired last year by the Okonite Company and adapted to its long-range facilities expansion plans.

SCHEDULE BOARD provided central control and coordination point for all operations involving machinery and key service installations under direction of plant engineer D. V. McParlin.

Conversion of the plant for the Okonite Co. was handled by: engineers and constructors—Wigton-Abbott Corp., Industrial and Chemical Engineering Div., Plainfield, N. J.; electrical contractor—Hatzel and Buehler, Inc., New York.

The plant, located on a 160-acre plot, is 1400 ft long and 360 ft wide at its widest point. It is a one-story construction, steel framework with cinder block and brick walls and with 6-in. concrete floors.

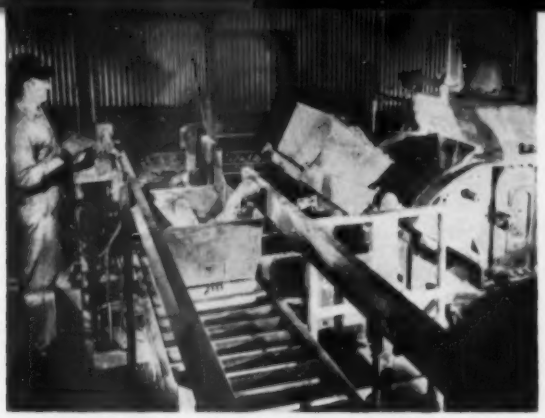
Two 26,400-volt circuits, one a stand-by, from the lines of Public Service Electric and Gas Co. of New Jersey serve a main outdoor substation located 400 ft south of the plant. Energy is transformed to 13,200 volts and distributed to five mezzanine substations inside the plant.

Original transformer equipment was capable of handling 6000 kva. This system was left intact and additional capacity of 5000 kva was installed to provide a special 4160-volt system serving the Banburies and heavy mills.

The original 13.2-kv circuits were 3-cond. 350,000-cm paper-insulated lead-covered cables installed in ducts. The new 5000-volt circuits are non-shielded rubber insulated cables. The most extensive changes were required in the 440-volt power secondary systems. Wire drawing and cable manufacture involves relatively large machines at fixed locations. Production expansion is provided for by allowing space and installing conduit connections for duplicate equipment adjoining the installed machines.

Existing secondary bus ducts were reconnected to serve the new dc system and as an extended "panelboard" for a portion of the ac power load. Major equipment power circuits were installed from the mezzanine power centers in rigid conduit under the floor to machine locations. Other power circuits were wired from bus plugs in rigid conduit down columns and under the floor to the machine locations.

Floor chases for the underfloor conduit runs were cut by rotary concrete saws. Down-column runs were supported by conduit clamps bolted to short lengths of steel channel welded to the column.



FEEDING COMPOUND BATCHES to Banbury mixer from materials conveyor. Banbury takes largest motor on 4160-volt power circuit.

EACH TEST PEN has four-way protection for maximum safety —gates with safety switches to trip the electrical circuits if accidentally opened; warning horn to announce start of test; flashing lights while test is on, and telephone communication.

Secondary electrical distribution within the plant is provided from substations on the five mezzanine areas which are equally spaced through the length of the plant. A total of six 1000 kva transformers supply the 440-volt power system. In addition, a bank of four high-voltage testing transformers serve the cable test area, and two 500-kva lighting transformers serve the plant lighting system. Direct current loads, special equipment requiring gradual starting such as cabling machines, are served from a 100-kw motor generator set.

The largest of the many plant motors is a 300-600 hp synchronous motor serving a No. 11 Banbury. This is operated on the new 4160-volt power system.

The original lighting system, designed to provide general lighting of 50 footcandles, consists of over 3000 two-lamp, 4-ft fluorescent fixtures. It is retained intact, with additional area lighting installed to meet special requirements. The electrical maintenance department estimates that relamping will take about seven weeks for two men. Lighting maintenance will be organized on a group replacement schedule.

Electrical Testing

One of the most unusual features of the plant is the planning and operation of the electrical testing department. The Testing Department is centrally located so that it can take care not only of material as it passes through the factory, but also finished products. The Shipping Department is adjacent to the test area.

In the test area are four elevator test tanks 16 ft deep, each with a capacity of 2700 cu ft of water. The elevators will handle 40,000 pound loads and can submerge reels 9 ft in diameter. Voltages up to 78,000 volts can be handled by the present testing equipment. Tests are made after the reels have been submerged for eight hours minimum. These tanks have a capacity of 20,000 gallons, a pretty substantial swimming pool.

Special features of the testing area involve 4-way safety controls. These comprise audible signals (horns), lights (flash signals), electrically-interlocked gates, as well as telephone communication between all areas and the control room. An illuminated annunciator board in the control room identifies which pens and tanks are in use.

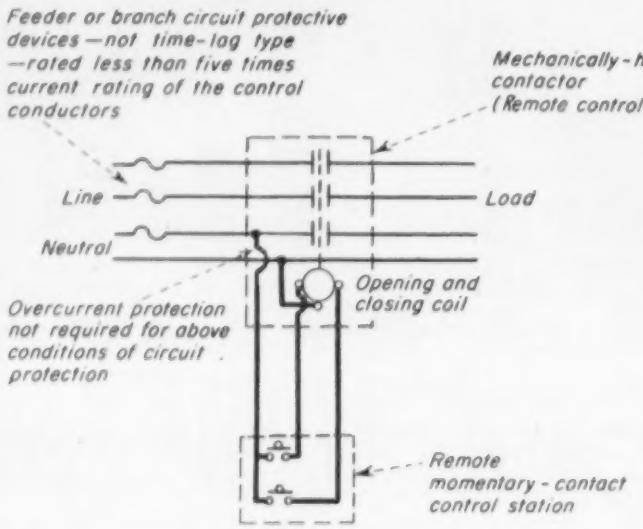
The elevator test tanks are totally enclosed within steel fencing, as are the dry test areas on the main floor. A safety lockout system prevents test voltage being applied when operators are in a test area. Voltage can only be applied after a matched plug is placed in the correct circuit.

The testing transformers are located on a mezzanine floor and are completely shielded electrically. An elaborate grounding system grounds out all metal structures and equipment throughout the Testing Department. In addition, these test areas are shielded so that corona testing can take place without interference. All equipment in the factory is grounded not only for the safety of personnel, but also to eliminate corona discharge or other electrical interference. In the test tanks the grounding system is connected to a counterpoise, which in turn, is connected to 6-in. channels encased in the concrete, and encircling the base of the tanks. These are grounded to an array of 30-ft rods. 500,000 CM copper conductors are used for grounding. A 1½-in. copper grounding bus surrounds all the test areas. All gates for the test pens are motorized. High voltage leads are 100,000-volt shielded X-ray cables, with special terminals developed for this work.

The test office and control consoles are located adjacent to the testing area and control room and will be air-conditioned. The test sets can be connected individually with each of the test areas and tanks. Insulation resistance sets are available to handle work in four separate locations. All test areas are visible to the operators from the testing room, and no one can enter any test pen without tripping the high voltage test circuits.

PROCESS WATER RECIRCULATION from cooling tower at 1500 gallons per minute is powered by two pumps.

Remote-Control Switch and Control Conductors


Feeder or branch circuit protective devices—not time-lag type—rated less than five times current rating of the control conductors
Mechanically-held contactor (Remote control switch)
Line
Load
Neutral
Opening and closing coil
Overcurrent protection not required for above conditions of circuit protection
Remote momentary-contact control station

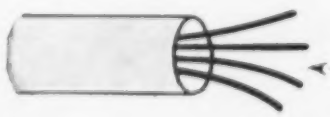
Protection of contactor remote-control conductors must follow section 2403-g. As shown at left, separate protection of the control conductors is not required under the given conditions. If the stated requirements were not satisfied, a fuse or circuit breaker would have to be inserted in the control circuit tap from the operating coil to the hot line conductor. And if the control circuit were energized from two hot conductors, both taps would have to be protected. Control circuit could have been derived from a separate source instead of the line side of the remote control switch.

Quick-check reference data on . . .

CODE RULES FOR REMOTE CONTROL

By J. F. McPartland

Class 1 Remote-Control Conductors



Conductors generally limited to minimum of No. 14 size, but No. 18 or No. 16 may be used if installed in raceway or approved cable or flexible cord and protected at not more than 20 amps.

1 Number of conductors limited in raceway in accordance with code tables 4 and 9, chapter 10.

2 Control conductors do not have to be de-rated according to number in raceway.

3 When control conductors are run in raceway with power and light conductors, all conductors must be de-rated in accordance with note 4 following tables 1 and 2, chapter 10, NEC—determining the de-rating factor on the basis of the number of power and light conductors only.

4 Conductors for two or more remote control circuits may be run in the same raceway—ac and/or dc circuits—if all conductors are insulated for the maximum voltage of any conductor in the raceway.

A "REMOTE-CONTROL circuit" is defined in Article 100 of the NEC as "any electrical circuit which controls any other circuit through a relay or an equivalent device." This includes circuits to relay coils and to operating coils of magnetic contactors, remote control switches and motor starters. Under the motor controller section of the code (Article 430) a "control circuit" is described as follows: "The control circuit of a control apparatus or system is the circuit which does not carry the main load current, and by means of which the electric signals directing the performance of the controller are transmitted."

General requirements for remote control circuits are covered in Article 725 of the code. Basically, remote control circuits are divided into two classes according to the power level handled by them:

Class 1 remote control circuits include—

STRONGEST—high-strength copper alloy for rugged strength. **MOST COMPACT**—the snuggest lug . . . easier terminating in tight spots. A cinch to tape. **FASTEST**—insert cable, tighten smallest size with screwdriver; larger sizes with Allen wrench. **SAVINGS**—through **KA-LUG'S** ease of installation, greater electrical dependability . . . as well as low initial cost.

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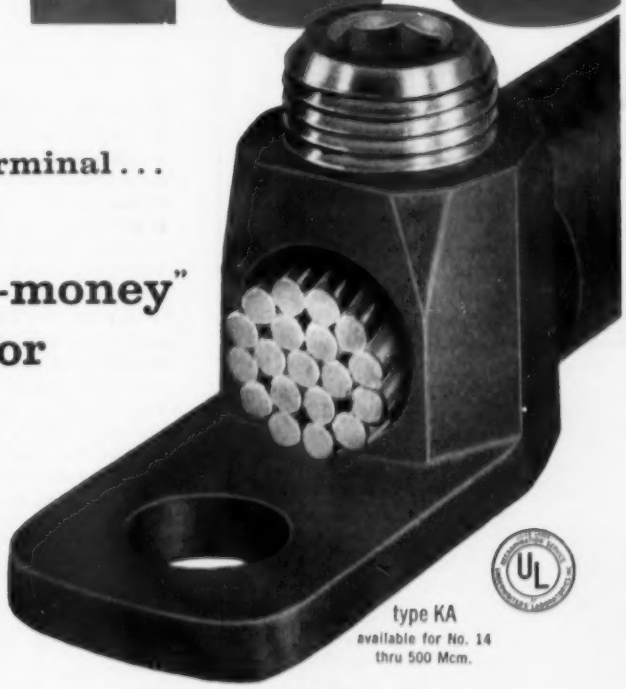

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1. Any control circuit operating at more than 150 volts, up to 600 volts.

2. Any control circuit which operates at not more than 150 volts and handles power in excess of the limitations set for Class 2 control circuits.

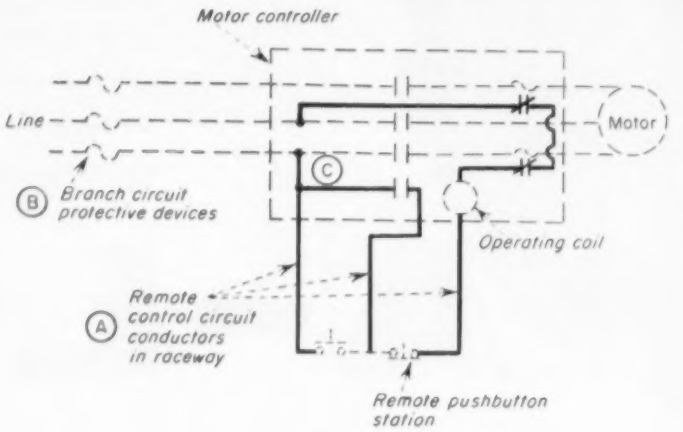
Class 2 remote control circuits include low-power control circuits in which power is limited as shown in the accompanying table.

Class 1 Circuits

In general, conductors and equipment in Class I circuits must be installed according to the requirements of Chapter 3 of the code. These are the standard wiring methods and provisions for regular power and light wiring up to 600 volts. In addition, however, other requirements for Class 1 control circuits are set forth in code sections 7262 to 7265 as follows:

- Remote-control circuits must conform to code requirements for control of specific equipment—such as for elevators in Article 620.
- Although Class 1 control circuit conductors, either solid or stranded, are generally limited by section 3103 to a minimum size of No. 14, smaller conductors—No. 16 and No. 18—may be used for remote-control circuits if installed in a raceway or approved cable or in flexible cords as set forth in Article 400.
- Control conductors smaller than No. 14 may also be used as follows: for printing press controls, No. 16 minimum for operating circuits of cranes and hoists, No. 20 minimum for operating control circuits of elevators and escalators, and No. 16 minimum for control conductors to moving parts of machine tools.
- Control conductors larger than No. 16 must be type R, Type T or other approved type. For No. 18 and No. 16 conductors, the insulation on the conductors must be equivalent to type RF-2 or type TF (fixture wires). Of course, any insulated conductors approved for the purpose may be used.
- In general, where damage to a remote-control circuit might create a hazard, all circuit conductors must be installed in conduit, EMT, MI cable or be otherwise suitably protected from mechanical injury.
- NEC table 4 or table 9, Chapter 10, indicates the number of remote-control conductors per-

Protecting Control Conductors for Motor Controllers

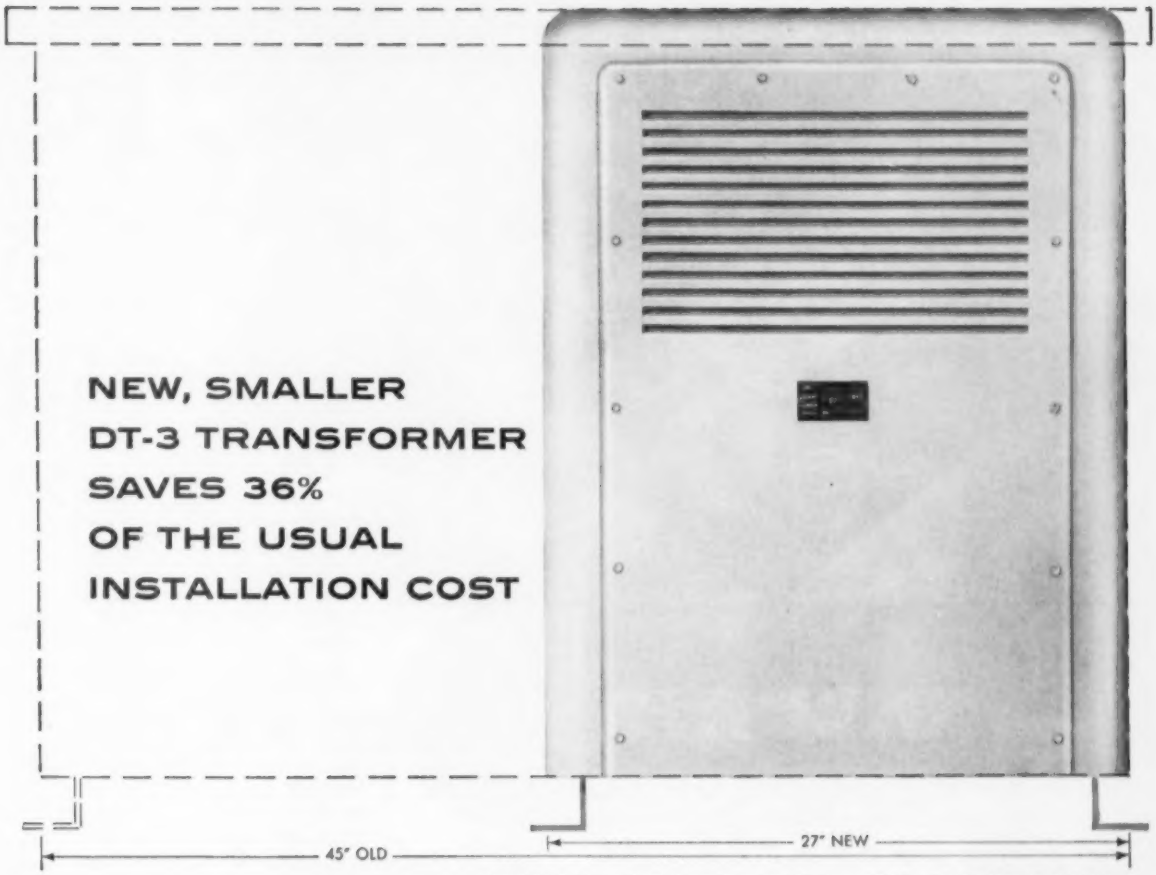


In general, remote control conductors must be protected against overcurrent. Section 2403-g of the code states that such conductors can be satisfactorily protected by overcurrent devices which are not of the time-lag type and are rated at not more than 500% of the carrying capacity of the control circuit conductors. Section 4372, however, modifies this requirement for motor control circuits as follows: The remote control conductors above (A) may be properly protected by the branch circuit overcurrent devices (B) if these devices are rated or set at not more than five times the current rating of the control conductors. If the branch circuit overcurrent devices were rated or set at more than five times the rating of the control conductors, the control conductors would have to be protected by separate protective devices located "at the point where the conductor to be protected receives its supply" (C). And in the case of motor control circuits, the branch circuit protective devices may be of the time-lag type and still qualify as protection for the control conductors. It should be noted that the overcurrent protection is required for the control conductors and not for the operating coil. Because of this, the size of control conductors can be selected to allow application without separate overcurrent protection.

Limitations of Class 2 Remote Control Circuits

Open-Circuit Voltage	Max. Rating of Overcurrent Protection	Remarks
More than 60 but not more than 150 volts	1 amp	Circuit must also contain current-limiting means other than overcurrent protection which will limit any fault current to not more than 1 amp.
More than 30 but not more than 60 volts	1.6 amp	Overcurrent protection is not necessary if circuit is supplied from a transformer or other device having energy-limiting characteristics and approved for the purpose.
More than 15 but not more than 30 volts	3.2 amp	Overcurrent protection is not necessary if circuit is supplied: 1. from a transformer or other device having energy-limiting characteristics and approved for the purpose, or 2. from primary batteries.
Not more than 15 volts	5 amp	

NEW, SMALLER DT-3 TRANSFORMER SAVES 36% OF THE USUAL INSTALLATION COST



New Westinghouse DT-3, three-phase transformer available up to 4800 volts, 45-300 kva.

The new DT-3, 3-phase dry-type transformer is the biggest stride in many years in bringing you moneysaving installations. Here's why:

1. *25-51% smaller than Class B, 80° 3-phase transformers.*
2. *New core and coil design slashes weight 17-32%.*
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These smaller, lighter, quieter transformers are easier to handle, can be mounted quicker, and fit more easily into convenient, close-to-load points. Installation cost is only ⅔ that of three single-phase units; completely interconnected and tested at the factory—just mount and connect leads. The official NECA *Manual of Labor Units* shows 14 hours of labor saved when installing one 3-phase, 45-kva transformer as against three single-phase units. Westinghouse DT-3 transformer weight advantage further increases this saving.

The new DT-3 transformer is designed with Group III insulation—exclusive Westinghouse Silclad—for 150° C rise; nonorganic silicone base. *CASE TEMPERATURES ARE LOWER THAN UNDERWRITERS' STANDARDS.*

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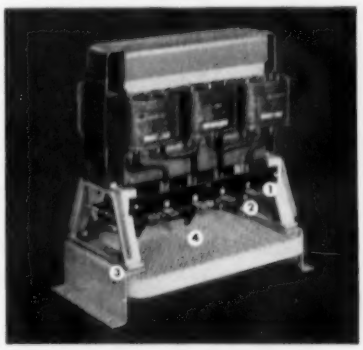

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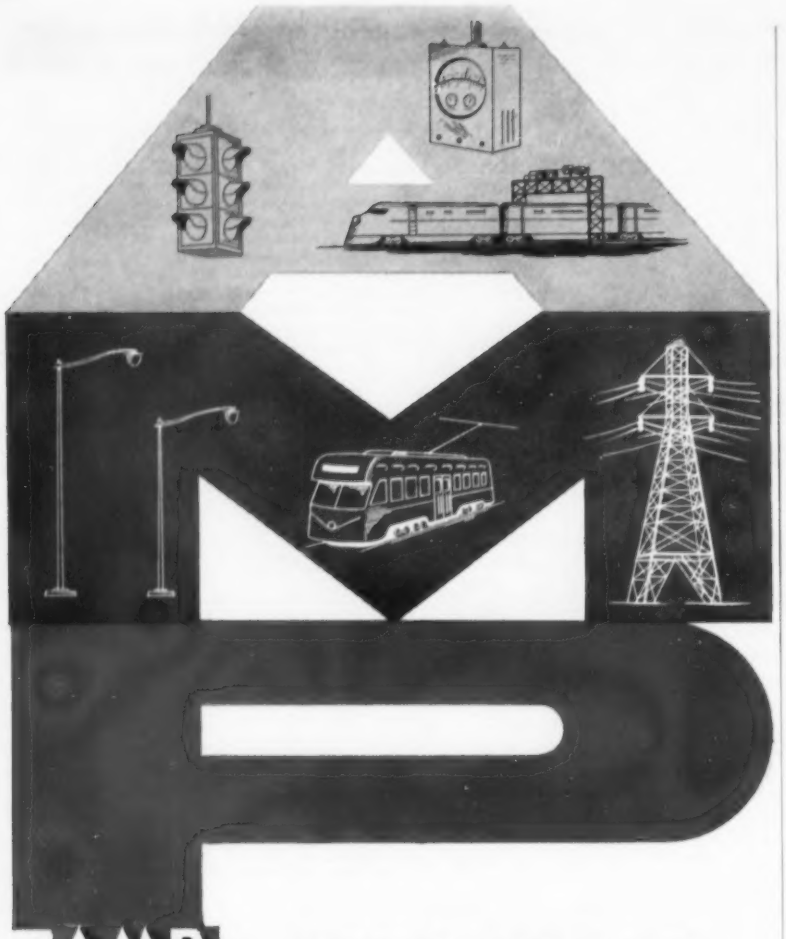
kva	(W)	Mfg-A	B	C	D	E	F
45	521	580	920	815	957	580	870
75	657	820	1275	1145	1500	915	1475
112½	876	1175	1710	1600	2070	1325	1950
150	1042	1500	2300	2060	2400	1600	2400
225	1480	2630	3000	3150	3150	—	3475
300	1718	3100	3900	4300	3800	—	4100



A-MP ...THAT'S FOR SURE

The ability of electricity to ease, broaden and speed the multiple activities of today's world rests on the promise of uninterrupted service. Failure or breakdown results in disruption and the irretrievable loss of time and money.

A-MP termination assures this promise of constant duty will be kept. No circuit is stronger or more reliable than the terminal at the end of a wire. The development of A-MP solderless termination removed the weakness and slow motion inadequacies of former type connectors.

A-MP solderless terminals have been designed and developed to meet the specific wiring requirements of electrical motivation, whenever and wherever it is generated, distributed, utilized or maintained.

A-MP Terminals, when required for maintenance and repair needs, are made available in the U.S.A. through American Pamcor Inc. api AMERICAN PAMCOR INC.

AMP INCORPORATED

GENERAL OFFICES:

7330 Eisenhower Boulevard, Harrisburg, Pa.

Wholly Owned Subsidiaries: American Pamcor, Inc., Havertown, Pa. (for maintenance and repair needs only) Aircraft Marine Products of Canada, Ltd., Toronto, Canada • Aircraft Marine Products (Great Britain) Ltd., London, England • Societe AMP de France, Le Pre St. Gervais, Seine, France • AMP-Holland N.V's Hertogenbosch, Holland

Distributor in Japan: Oriental Terminal Products Co., Ltd., Tokyo, Japan

CODE RULES FOR REMOTE CONTROL

[FROM PAGE 120]

mitted in a raceway. The allowable current-carrying capacities of these conductors do not have to be derated for more-than-three-conductor raceway fill, as required with standard power and light wiring, unless there are four or more conductors in the raceway, some of which are power or lighting conductors. In such cases, conductors must be derated according to Note 4, after Tables 1 and 2, on the basis of the number of power and lighting conductors only.

● A number of ac and/or dc remote-control circuits may be installed in a single enclosure or raceway if all of the conductors are insulated for the maximum voltage of any conductors.

● Power circuit conductors may occupy the same enclosure or raceway with Class 1 control conductors only if they supply the same equipment which the Class 1 conductors serve to control.

The code requires that remote-control conductors be protected against overcurrent by devices "that are not of the so-called time-lag type and are rated or set at not more than 500%" of the allowable current-carrying capacities of the conductors. For motor control circuits, the same requirements are made except that the branch circuit overcurrent device may be taken as sufficient protection, even if it is of the time-lag type, in any of the following cases:

a. If the branch circuit device is rated or set at not more than 500% of the current rating of the control conductors.

b. If the controlled motor and the switching device for the control circuit are both located on the same machine and the control circuit does not extend beyond the machine.

c. If opening of the control circuit would create a hazard—as in the case of a fire-pump motor.

The control circuit for any motor controller must be arranged to be disconnected from its source of supply when the motor circuit disconnecting means is in the open position. Two devices may be used for disconnecting—one for the controller and motor, opening the main power circuit; and the other for disconnecting the control circuit

2400 punching blows a minute!

BREAKING holes through concrete or brick; this work is easier with bull point tool.

ROUGHING UP concrete with B&D Bushing tool provides good bonding surface.

CHANNELLING for conduit with a cold chisel goes almost as fast as drawing a line on the floor.

Swifty Service says: Even the best tools sometimes need repair. When yours do, give 'em B&D Factory Branch Service.

Black & Decker Electric Hammers POWER-BUILT for rugged service!

Rugged Black & Decker Electric Hammers pack plenty of punch for hundreds of electrical jobs . . . send your man-hours tumbling, get more work done in less time! For drilling, digging, piercing, breaking, chiseling, gouging, channeling or shaping — for working in concrete, stone, brick, wood or metal — here's the electric hammer for top performance.

Completely self-contained, 4 light-weight Black & Decker Electric Hammers need no converters or rectifiers. Everything needed for the job — hammer, tools turning handle, oil — carried in one compact, sturdy carrying case.

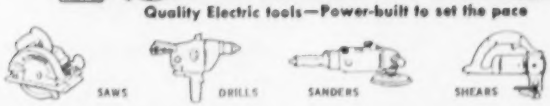
See your Black & Decker distributor for demonstrations. For additional information write to: THE BLACK & DECKER MFG. CO., Dept 1207, Towson 4, Md. (In Canada: P.O. Box 278, Brockville, Ont.)

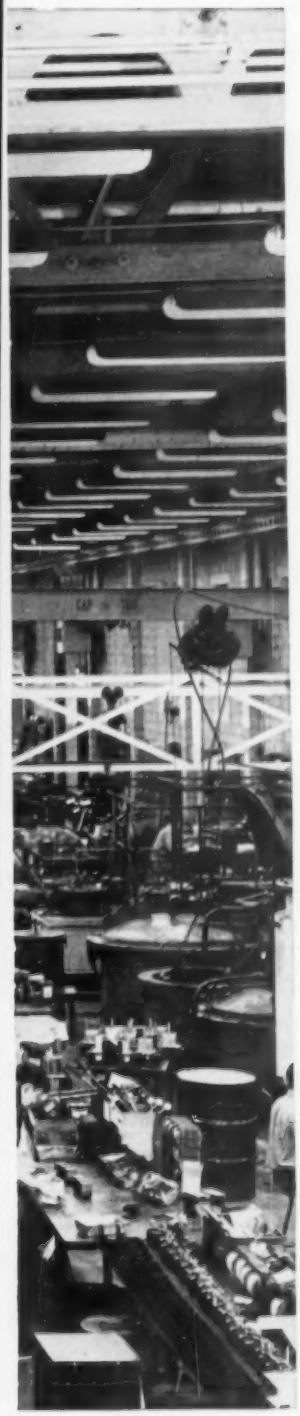
Look Under TOOLS-ELECTRIC in Yellow Pages

Leading Distributors Everywhere Sell

B&D Black & Decker

Quality Electric tools—Power-built to set the pace





Here's how Westinghouse power centers increase plant output...safely

Safe, efficient power distribution that actually helps increase plant output . . . that's what this Western Pennsylvania manufacturer realized by installing modern Westinghouse dry-type power centers.

Dry-type power centers minimize installation costs because they are completely safe. Since they are *both* fire and explosion resistant, they can be located right in the production area. They require no vaults, catch basins, toxic gas vents, or drains. Lightweight, they can be installed overhead, releasing valuable floor space for production. This makes it easier to locate them close to the load they serve, shortening secondaries, cutting line losses, improving regulation. The result: Increased production efficiency.

In the plant pictured at the left, two Westinghouse power centers divide the load. Capacity is provided in each to allow for expansion.

Add these up for your plant: (1) Safe, economical installations. (2) Increased production space. (3) Increased plant efficiency through improved regulation. (4) Savings in power cost through reduced losses. (5) Savings in heavy copper through shortened secondaries.

Westinghouse power centers can bring these advantages to your plant, too. Because they are factory assembled and coordinated as one unit, with components designed to meet your individual requirements, they can be installed quickly and easily. For further information, check with your contractor, your Westinghouse distributor or local representative, or write direct to Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.

J-70708

YOU CAN BE SURE...IF IT'S Westinghouse

The stoutest pipe vise
. . . with built-in
folding legs and tray
RIDGID
Tristand Pipe Vise
Extra easy to fold up, carry and set up . . . Extra strong, extra rigid in use
Every RIDGID Pipe Tool TESTED individually before shipment
Most service and durability for your money! Integral legs and tray mean quick easy fold-up for carrying and set-up for work—provide solid stance, greater strength. Vise base is roomy, has ceiling brace screw, conduit benders, slots for tools. Special LonGrip jaws grip tight without marring. Save work—see it, try it, buy it at your Supply House.
RIDGID Tristand Pipe Vise, yoke model.
Chain model also available.
The Ridge Tool Company, Elyria, Ohio, U. S. A.
RIDGID
Work-Saver Pipe Tools

CODE RULES FOR REMOTE CONTROL [FROM 122]

from its supply. These two disconnects should be installed "immediately adjacent" to each other. If a transformer is used to obtain a stepped-down voltage for control, the transformer should be connected to the load side of the disconnecting means.

Class 1 remote-control circuits must be grounded according to the standard grounding requirements if the circuits are supplied by a separate control transformer from a system operating at more than 150 volts to ground.

Class 2 Circuits

In addition to the basic limitations on the amount of power which a Class 2 circuit may handle, such circuits may not be served from a transformer device unless the device is approved for the purpose and rated not more than 100 volt-amperes. Installation requirements include the following:

- Standard wiring methods and techniques must be used on the supply side of overcurrent protection, transformers or current-limiting devices serving Class 2 remote-control circuits.
- Transformers supplied from light or power circuits must be protected by overcurrent devices rated or set at not more than 20 amps.
- Circuit conductors on the load side must be separated from light or power conductors and must not be used in any raceway or outlet box with such conductors or with conductors of Class 1 control or signal circuits.

RETIRING PRESIDENT Charles Covington (right), Dowzer Electric Machinery Works, Mount Vernon, Ill., receives congratulations on a job well done from George Svendsen, Boustead Electric and Manufacturing Company, Minneapolis, Minn., during brief lull in this year's annual NISA convention in Buffalo.

Now . . . CHASE takes the wraps off the greatest tape saver in years!

New Saran Wrap* packaging prevents costly storage losses . . . keeps every roll "factory fresh"

CHECK THESE ADVANTAGES and see for yourself why Chase's revolutionary new moisture-proof packaging assures top taping qualities in every roll of Chase Electrical Tape you buy.

SEALED-IN FRESHNESS! Because it has the lowest moisture vapor transmission rate of any transparent packaging material, Saran Wrap actually *seals out* harmful moisture . . . *seals in* factory freshness. Saran Wrap's superior packaging characteristics also help prevent peeling, drying out or raveling . . . assures lasting tack in roll after roll.

MAXIMUM PROTECTION! Tough, transparent Saran Wrap molds itself to each roll to form a neat, weather-resistant package . . . protects Chase Tapes against dust, dirt and drying out in between jobs.

LONGER STORAGE LIFE! Fresher, *longer-lasting*, Chase Saran-Wrapped Tapes eliminate troublesome storage problems . . . permit adequate stocking to meet both immediate and long range requirements.

Try several rolls of Chase Saran-Wrapped Tape now! Order through your distributor or write us for complete details. Chase & Sons, Inc., 26 Spruce Street, North Quincy, Massachusetts.

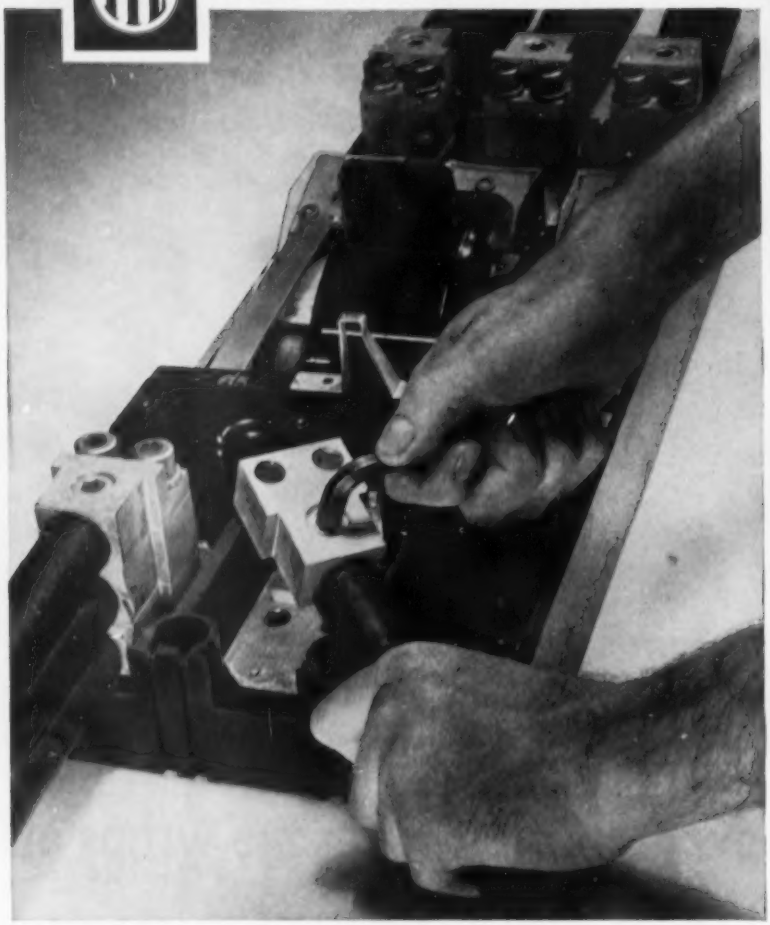
**Trademark of the Dow Chemical Company for its vinylidene chloride copolymer film.*

CHASE & SONS INC.

North Quincy • Massachusetts

CABLE INSULATING TAPE • CABLE BINDING TAPE
CABLE JACKET TAPE • NEOPRENE SPLICING TAPE
FRICTION, RUBBER & PLASTIC TAPE
LAMINATED & REINFORCED INSULATION

MOLDED CASE CIRCUIT BREAKERS



These individual cable lugs, each with an Allen head locking bolt, make connection of cables far easier and provide a much sturdier, neater assembly. An exclusive on all I-T-E 800 ampere breakers. UL approved for service entrance equipment.

I-T-E enclosures are side-hinged—no need to remove, or prop up, the cover. It is nevertheless easily removed, the hinge being of the pin-and-socket type—lifts off and on readily.

Field checks indicated that the addition of a supporting bracket would be a big help in installing larger breakers, and this feature is now added on all large-size enclosures.

To facilitate drilling holes of the desired size and position, end-plates of larger enclosures can be unscrewed and removed. Drill to your exact conduit needs.

SEVERAL EXCLUSIVE I-T-E FEATURES COMBINE TO SAVE YOU MONEY WHEN INSTALLING CIRCUIT BREAKER EQUIPMENT

In designing molded case circuit breakers for higher capacities, for example, I-T-E design engineers recognized that the difficulties inherent in making large multiple cable connections had to be considered. Pictured above is their solution—"stacked" lugs for time-saving installation. No need to fight clumsy, unyielding cables.

I-T-E enclosures, too, have exclusive, built-in features which greatly facilitate installation of circuit breaker equipment—saving additional installation time. And since time is certainly money these days, consider the time-saving features pictured here and you'll see how I-T-E can save you money even before your I-T-E breakers are in service!

I-T-E CIRCUIT BREAKER COMPANY • **Small Air Circuit Breaker Division**

19th & Hamilton Sts., Philadelphia 30, Pa.

IN CANADA: EASTERN POWER DEVICES LTD.

Practical Methods

Modernization Program Features Lighting Variety

ILLUMINATION

A just-completed 4-floor retail store—first in a nationwide modernization and expansion program by Montgomery Ward—is receiving favorable attention in Portsmouth, Ohio. The structure (largest contemporary commercial building in that community) is windowless in construction (except for ground-floor display windows), is completely air conditioned, is pleasingly illuminated by a combination of various fluorescent and incandescent treatments, and is provided with vertical transportation through the mediums of fully-automatic freight and passenger elevators as well as moving stairways.

As illustrated by acompanying photographs, lighting treatments include flush-mounted 4-ft-sq fluorescent panels (containing center incandescent lamps as well), large luminous ceiling areas (using Honey-Lite panels as the shielding agent), numerous linear valance and cove treatments, plus both recessed and adjustable suspended spotlights for highlighting merchandise on counters or free-standing display stands.

Design and construction of the building, by The Austin Company of Cleveland, combined efficiency and functionalism with maximum usable floor space, for air conditioning equipment is mounted out-of-the-way in roof penthouses, individual air-handling units are either concealed in dropped ceiling sections or placed behind stock-area partitions, and stock storage utilizes perimeter areas immediately adjacent to their related departments. This arrangement of the windowless building depends completely upon artificial illumination for lighting, permits uniform and consistent lighting results, lessens infiltration of dust and dirt, also lessens the air-conditioning load, and promotes merchandising efficiency by keeping stock and sales areas closely adjacent.

Due to the numerous high-intensity fluorescent and incandescent lighting treatments, plus the existence of the aluminum-framed see-through display windows (that extend ⅔ the length of the main facade), the store creates an illusion of openness and light. This illusion is also furthered by construction details such as wide column spacing and high ceilings.

Opening date for the store was speeded materially by close cooperation between The Austin Company and Ward, for, as various floors were lighted and decorated, they were progressively turned over to the store management for stocking and display purposes. Therefore, only seven months after the start of construction (with final completion still three months removed), some of the floors were "ready for business." Considering that the store is located at the town's principal intersection, and that traffic

LUMINOUS CEILING area utilizes Honey-Lite panels as shielding and diffusing medium, while adjacent section is illuminated by 4-ft-sq flush-mounted panels (combining a central incandescent lamp in each fluorescent assembly), plus recessed down-lites.

LIGHTING TREATMENTS also include various cove and valance techniques, back-lighted signs and display-case edge-lighting strips. Vertical transportation is provided by elevators and moving stairways in this air-conditioned building.

YOUR MOST DEPENDABLE SOURCE OF BOXES & FITTINGS...

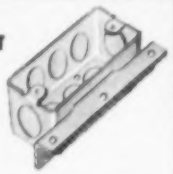
Arrolet

Preferred by more contractors today, because ARROLET's products answer modern installation problems, saving time and costs.

HANDY BOX with MOUNTING BRACKET

1⅞" deep.—Made with new type angle bracket for quick, accurate installations.

Cat. No. HB-10-BA



3¼" ROUND BOX

½" deep.—With or without stud for use in ceiling or wall construction where very shallow box is needed.

Cat. No. 11-S

NON-GANGABLE SWITCH BOX

1½" deep.—For thin wall or concrete block construction. Available with ½" K.O.'s for use with conduit. May be nailed on or can be had with several types of brackets.

Cat. No. 200

ARROVAL FITTINGS

Oval type, threaded, for standard rigid conduit. In ½", ¾" and 1". Covers and gaskets available in various sizes and types.

ARROLET products are available in an unlimited number of combinations, types, sizes and wiring capacities to fit any job specification.

When you have an installation problem not covered by our standard line, our engineers will design special units to your specifications.

Write for Our New Catalog.

Arrolet CORPORATION

MONTGOMERY PENNA.

Sales Representatives & *Warehouse Stocks

BALTIMORE, MD. • CHARLOTTE, N.C. • *CHICAGO, ILL. • *CINCINNATI, OHIO • DENVER, COLO. • *LOS ANGELES, CALIF. • *MIAMI, FLA. • NEW ORLEANS, LA. • NEW YORK, N.Y. • NEWTON CENTRE, MASS. • *PHILADELPHIA, PA. • ROCHESTER, N.Y.

COUNTERS AND DISPLAYS in open areas are highlighted by both recessed and suspended, adjustable spotlights, while recessed wall niches are illuminated from above and sides by fluorescent strips. Judicious use of color furthers attractiveness of decorations and furnishings.

LIGHTED LETTERS 5 ft high identify new retail outlet, while show windows (lighted primarily by spotlight units positioned along trolley duct above window edge, also behind translucent backdrop) attract attention of night-time passers-by.

was never halted during this period of material-and-goods receiving, structural work and decorating, the operation represents a high order of cooperation and coordination between the many trade groups and merchandising interests involved in this project.

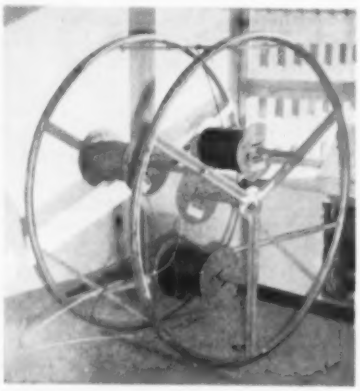
Circular Dolly Speeds Branch Circuiting

WIRING

By using a rolling aluminum wire dolly as an installation tool, journeymen working on Philadelphia's new Sheraton hotel project for the Keystone Engineering Corporation were able to simplify normal wire-handling methods to a considerable extent.

Since this lightweight dolly is circular in shape and compact in its dimensions (5 ft in height and 30 in. in overall width) it can easily roll in and out of elevators and through normal-width guestroom doors. Also, since it can contain two 2000-ft No. 12 wire reels on each of four horizontal shafts, electricians could start each daily assignment with over three miles of wire conveniently on hand.

Framing sidewheels are of 1½-in. tubular aluminum; horizontal reel-supporting cross shafts are 1-in. conduit; radial bracing from hubs to rims consists of 2-in. channel sections; and X-frame bracing between the rims themselves is formed from 1-in. angle stock. X-framing is secured by bolts and



LIGHTWEIGHT aluminum rolling dolly holds eight 2000-ft reels of wire on disposable spools. Compact dimensions permit dolly to freely pass through normal elevator or guestroom doorways. Rig was specially constructed for Keystone Engineering Corporation by Philadelphia shop.

UL approved for direct cable burial, Rome's FlexAll makes it easy for you to keep the wiring out of sight.

How Rome's multi-purpose UF cable can help you "sell up" outdoor lighting

and get those extra wiring jobs that mean more profit

By "selling up" when contracting to wire a home, you can increase the amount of extra lighting you install—such as carriage lamps—and thereby boost your profits.

Rome's FlexAll—a nonmetallic sheathed UF cable—can help you get a larger number of outdoor residential lighting jobs. Low in price and easy to install, FlexAll reduces your installation costs and enables you to quote a more attractive price when "selling up" additional lighting.

Installs easily, lasts for years. FlexAll, when provided with overcurrent protection, is ideally suited for direct burial in the earth and its flexibility makes it easy to handle. Insulated with Rome Synthinol (polyvinyl chloride) thermoplastic compound, FlexAll provides exceptional resistance to the corrosive elements in the earth. In addition, it has high dielectric strength and excellent aging characteristics.

Helps you to "sell up." Merchandise your services, don't just make them available. Sell your customers on filling their future needs *now*. Get that extra wiring—lights for the barbecue pit—gate lights—carriage lamps—and *keep the wiring out of sight*. FlexAll permits you to put more wiring into many of your residential wiring jobs.

Specify Rome's FlexAll for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 346, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

109

PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

nuts, although all other angle-to-channel junctions are welded.

Another practical idea was to order wire on disposable plywood-and-paper-maché spools which could be discarded when exhausted, instead of having to return them to the manufacturer or dealer's warehouse for credit and subsequent re-use. This detail further lessened handling of materials, precluded the possibility of reel damage or loss, and also reduced the amount of storage space which formerly was occupied by empty reels awaiting rotational return to their source.

Closed-Circuit TV For Turbine Assembly

PRODUCTION

Almost daily Werner Hillman plays the part of a director, producer and stage hand in a closed-circuit television production at General Electric Company's Gas Turbine Department at Schenectady, N. Y. Using a General Electric "Intratel" closed-circuit television camera, Hillman correctly and accurately places into position a four- to five-ton gas turbine section. Previously the turbine shells were aligned only by stretching a taut wire through the turbine and estimating when the shells were in position.

When lining up the turbine shells, the camera is bolted, leveled

TV RECEIVER, at left, is reproducing a picture of internal alignment of turbine sections, over a closed circuit hookup with TV camera shown in center of turbine section at extreme right.

If voltage drop is not a problem...

Save up to 15% on cost of 100-amp service for new housing with Rome's improved SE cable

You can now substitute No. 3 AWG copper conductors for the more expensive No. 2 AWG in 100-ampere service locations where voltage drop is no problem. U/L approval of Rome's improved Type SE service entrance cable for 75°C. operation makes this economical substitution possible, and you can save up to 15% of the cost of installing 100-ampere service.

Easy to use. Approved for high-temperature operation in *either dry or wet locations* when insulated with Rome's heat- and moisture-resisting compound, you'll find Rome's Type SE cable easier to handle because of its lighter weight. Saturated cotton braid—one red and one black—over each conductor provides quick and positive conductor identification. Its neat, neutral-gray finish readily blends with the outsides of most homes, and it can easily be painted when necessary. The over-all outer braid is both flame- and moisture-resistant; and—for identification—it's surface-printed: "SE-Style-U 75°C." It resists becoming tacky, even under severe storage conditions.

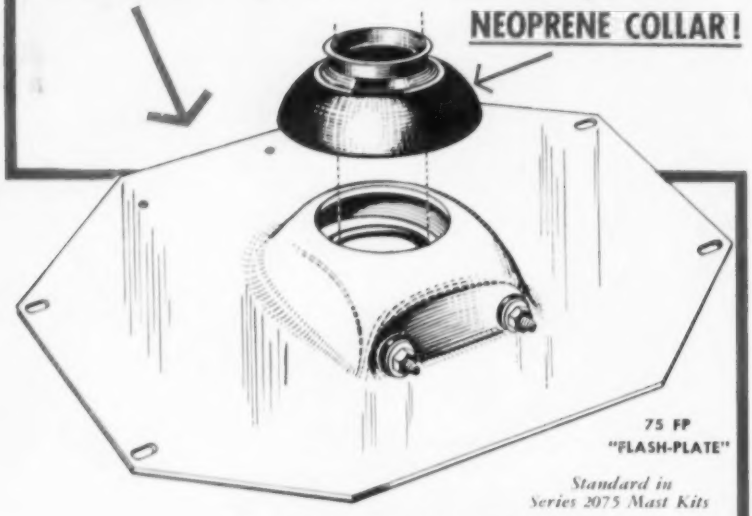
Specify Rome's service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 364-B and ask for Bulletin SE-1. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

new

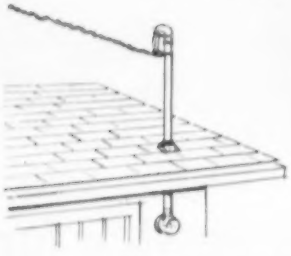
from Porcelain Products . . . combination roof-plate and flashing with NEOPRENE COLLAR!



75 FP "FLASH-PLATE"

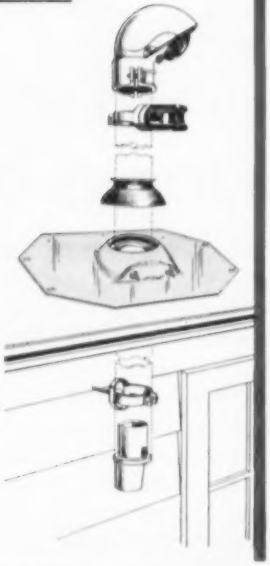
Standard in Series 2075 Mast Kits

Makes installation



- **QUICKER—fewer parts**
- **EASIER—no caulking**

at Less Cost!



Now, Porcelain Products Mast Kits feature FLASH-PLATE, a combined roof-plate and flashing, plus a lifetime, watertight Neoprene collar. The "one-piece" feature makes Porcelain Products Mast Kits easier to install . . . provides a stronger, longer lasting, safer entrance mast . . . ALL AT *LESS* COST TO YOU!

Flash-plate is heavy, 14 gauge galvanized plate. It supports a 2″ or 2½″ mast on any roof, neatly and effectively, *with no caulking* needed. Write today for further information and free quantity of installation instructions.

ELECTRICAL PORCELAIN SINCE 1894

63 years **Porcelain Products, Inc.** PP INC.

FINDLAY, OHIO

and centered on the first or master shell. When another shell is to be attached, a target is centered in the new shell and the camera lens focused to the known distance to the target. Then by watching the monitor, located some 15 ft from the camera, Hillman notes where the target lies in relation to the camera lens. Thus, he is able to carefully adjust the shell-connecting bolts, and align the new shell.

The closed-circuit TV chain, consisting of camera, cable and monitor, was developed by the company's Technical Products Department at Syracuse, N. Y. The camera is equipped with a telescopic lens and was especially designed to operate under the rugged conditions and low light levels often found in industrial applications. The monitor resembles a home TV receiver, but because of its 600-line resolution, brings in a picture which is much clearer in detail than that of a home receiver.

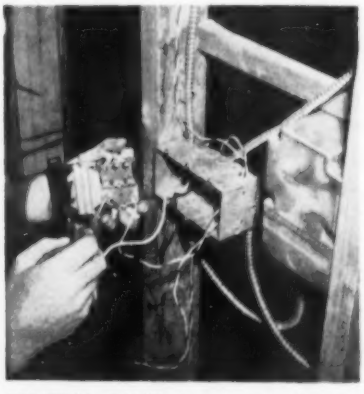
The unit being assembled is the largest gas turbine yet to be manufactured in the Western Hemisphere. It is rated at 16,500 kilowatts and will be installed in Monterey, Mexico.

Fire Alarm For Homes

SIGNALS

A simple, easily-installed fire alarm system can be added to new homes while they are under construction to add a valuable, highly important feature to the finished home. Such a system is made by Edwards Co., Inc., Norwalk, Conn., to provide low-cost, effective protection against the undetected presence of fire in a home.

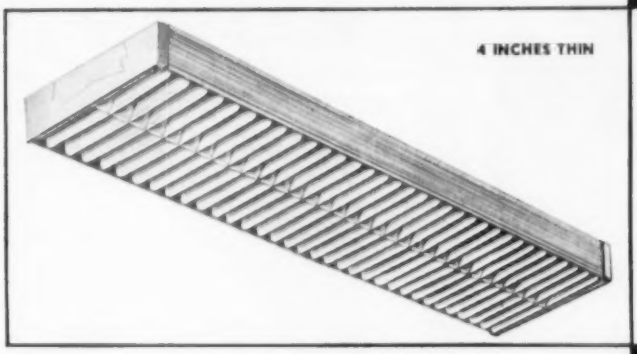
The system is completely auto-



CONTROL PANEL is a small, compact unit powered by a bell transformer.

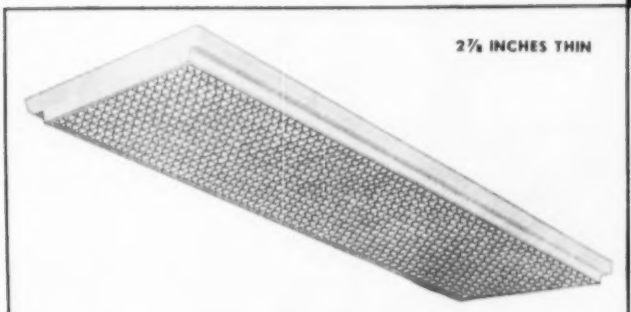
philite BIG 2 IN THIN ...TRIM LIGHTING!

SERIES 20



- 4 and 8 foot lengths for 48" Rapid Start or 48" and 96" Slimline lamps — widths: 2 lamp 11¾", and 4 lamp 21".
- Choice of Polystyrene or steel sides.
- Hinged baffle louvers — 35°x35° — 35°x45° shielding.
- Surface or pendant mounting — easy to install.
- Individually packed for ease in handling.

SERIES 21



- 4 and 8 foot lengths for 48" Rapid Start or 48" and 96" Slimline lamps — widths: 2 and 3 lamp 14¼", and 4 and 6 lamp 27".
- 5 different shieldings — Hinged Plexiglas, Vinyl, Plastic Louver, Alba-Lite Glass, Corning No. 70 lens — evenly diffused light.
- Heavy gauge steel construction.
- Surface or pendant mounting — easy to install.
- Individually packed for ease in handling.

Write for catalog pages

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philite
PROVEN LIGHTING

VETO
THE
V-AMP-IRE
with
this
DIAMOND
MARK
of
QUALITY

Your customers will appreciate the low lamp replacement and maintenance costs that always go with using Champion Incandescent and Fluorescent Lamps.

CHAMPION

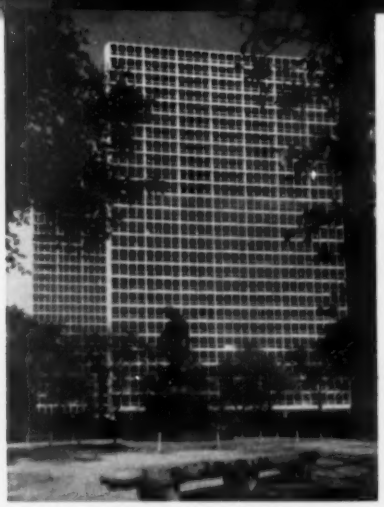
it means you're getting the most light for your money in lamps

CHAMPION LAMP WORKS
Lynn, Massachusetts
INCANDESCENT • FLUORESCENT

CIRCUIT RUNS to fire detector units are made with bell wire from the control panel.

DETECTOR UNITS are mounted at highest possible levels in rooms, attic and basement, quickly supported by wood screws.

matic. It operates on a small bell transformer and control unit which can be easily mounted in a standard 3-gang outlet box in the bedroom. The control panel measures about 4¾ in. by 6½ in. for surface or flush mounting. The control panel assembly contains the transformer and warning bell and is equipped with a test button which can be used to test the operating condition of the bell unit. From the control panel, 2-wire detecting legs are run to any number of small fire detectors strategically placed at ceiling level or other high levels throughout the house where undetected fires might occur and in other places. Ordinary bell or thermostat wire is used to connect the fire detectors to the control panel. As shown in the accompanying illustrations, the wire runs to the detectors are quickly and easily stapled to the surface of studs and joists. The detectors are mounted on the surface under joists or even on lath



The first two units of Commonwealth Promenade are now occupied. SPANGLEAM EMT protects wiring throughout the 377 apartments. Power enters building at 480 V and is transformed to 240 V to prevent power drops.

Hyre Electric saved 50% installation time at Commonwealth Promenade Apartments by using SPANGLEAM EMT. SPANGLEAM is light weight, easy to work with, has high corrosion resistance.

SPANGLEAM EMT does double duty at Chicago's Commonwealth Promenade Apartments

250,000 ft of SPANG thin-wall conduit protects all wiring, serves as a "spider-web" for decking

"We chose SPANGLEAM EMT for the Commonwealth Promenade Apartments because it can be installed in 50% of the time required for heavy conduit," says Mr. Leonard W. Martens, foreman, Hyre Electric Company, Chicago. "It couples quickly, is light weight and easy to handle.

"Commonwealth Promenade is all-electric. To handle all fixture and appliance requirements, 10,000 ft of ½" to 2" SPANGLEAM EMT was used on each floor—6,000 ft in the decking and 4,000 ft for 'nippling up.' All conduit is imbedded in 2" concrete decks and walls."

SPANGLEAM can save you time, too!

The excellent SPANGLEAM exterior finish is highly corrosion-resistant and makes an excellent appearance in exposed locations. It does not chip, flake or peel, even under severe bending strains. The smooth, slick interior finish makes wire pulling easy. For your convenience and easy handling, SPANGLEAM is bundled in blue plastic tape.

Give SPANGLEAM EMT a try. You'll like the way it works for you. Ask for it at your local SPANG Distributor's.

Architect: Friedman, Alschuler & Sincere
Associate Architect: Mies Van Der Rohe & Ludwig
Construction Engineer: William Goodman
General Contractor: Herbert Construction Co.
Electrical Contractor: Hyre Electric Co.
Spang Distributor: Electric Supply Corporation
(All located in Chicago, Illinois)

SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities

NEW ENGLANDERS at the NISA Buffalo meeting included Brent Smith, White Electric Service, Lowell, Mass.; Pete Mercier and Hector Monro, New England Machine and Electric, Pawtucket, R. I., all of whom were interested in analyzing statistics pertaining to the motor-repair industry, past and present.

before plastering to provide semi-concealed units in bedrooms, etc.

The fire detector units contain a bimetallic element which operates them. When heat rises to a dangerous temperature at a detector, the heat deflects the bimetallic element, closing the circuit to sound the alarm. The detectors are mounted as high as possible because heat and superheated gases present during a fire rise to the top of any room or area.

Fixture Jack Is Practical Installation Aid

LIGHTING

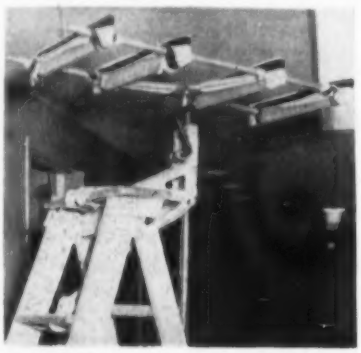
A modified version of the worm-gear auto jack has been adapted to facilitate lighting fixture installations, making it possible for one man to easily raise a fixture into position, hold it firmly in place while he wires the unit, or to press it snugly into a ceiling cavity or against framing members while the mounting bolts or screws are inserted and tightened.

As indicated by the accompanying photographs, a vertical ratchet bar is moved up or down by means of a geared crank which, in turn, is mounted to an offset bracket that attaches to the top of a stepladder. Actual attachment of the bracket is by means of horizontal claws (that rest upon and grasp the lead edge of the top step) and by an inclined bar-and-clamp arm which attaches to the second step down and which permits exact leveling of the fixture-supporting rig. The supporting assembly at the upper end of the ratchet bar consists of a cast X-frame, two horizontal parallel bracket bars and four connecting rubber-edged crossarms. These crossarms form an excellent cradle for resting a 4-ft fixture and if proper balance is maintained, the cradle is also capable of being used to raise an 8-ft luminaire into position.

Likewise similar to the construction of an auto jack, a one-way-action cog prevents back-slippage, thereby preventing the fixture from sliding downwards. If the electrician so wishes, however, he may manually release this one-way brake, then lower the cradle for adjustments or re-positioning.

This practical fixture-mounting method was used to advantage by electrical crewmen of the Keystone Engineering Corporation during construction of a new Sheraton hotel in Philadelphia.

ONE MAN can position, raise, wire and secure a 4-ft lighting fixture easily with the aid of this manually-cranked gear- and ratchet device which proved to be a valuable installation tool during construction of a new hotel in Philadelphia.



LIFTING RIG consists essentially of vertical ratchet bar, ladder-supported bracket, crank, anti-slip brake and cradle for supporting luminaire. This device was used by Keystone Engineering Corp. of Philadelphia to great advantage.

Power Conduit Under Gas Pressure

DISTRIBUTION

One of the nation's larger installations of high voltage underground cable—44,000 ft of lines capable of carrying 110,000 volts—is now underway in San Francisco with lines snaking their way under the city's streets to bring more power from new generators being installed at Pacific Gas & Electric Company's Hunters Point Power Plant.

Costing approximately $2 million, the project employs a unique installation method. The high voltage lines are laid underground in steel pipe conduit filled with nitrogen gas under pressure. The cable is insulated with a $\frac{1}{2}$-in. thickness of paper insulation with the inert gas filling the paper and any remaining space in the pipe. The gas under pressure contributes to the electrical insulation of the cable and maintains a constant watch on the gas-tightness of the lines through low pressure alarm relays.

As shown in the picture, each welded section of the pipe is tested for gas-tightness before the cable is installed. The test is made by fitting a water jacket around the welded joint and placing it under pressure. Any defects in the weld can be detected through tell-tale bubbles.

This method of insulating electrical underground cables is relatively new in the industry. Although the initial cost of installation is high, upkeep and maintenance are low.

The PG&E cable installation is one of the biggest undertaken in the last few years. More than eight miles of 6$\frac{3}{8}$-in. electric weld pipe, manufactured by Kaiser Steel Corporation, are being used.

Mr. Plus proves his point

Electrically the smart new building of American Bakeries, Fayetteville, N. C., (below) is as modern as a plant can be. An all-Westinghouse system was installed by Barnhill Electric Company, working with Southern Builders, Inc. of Fayetteville. Some of the equipment installed is described on the next pages.

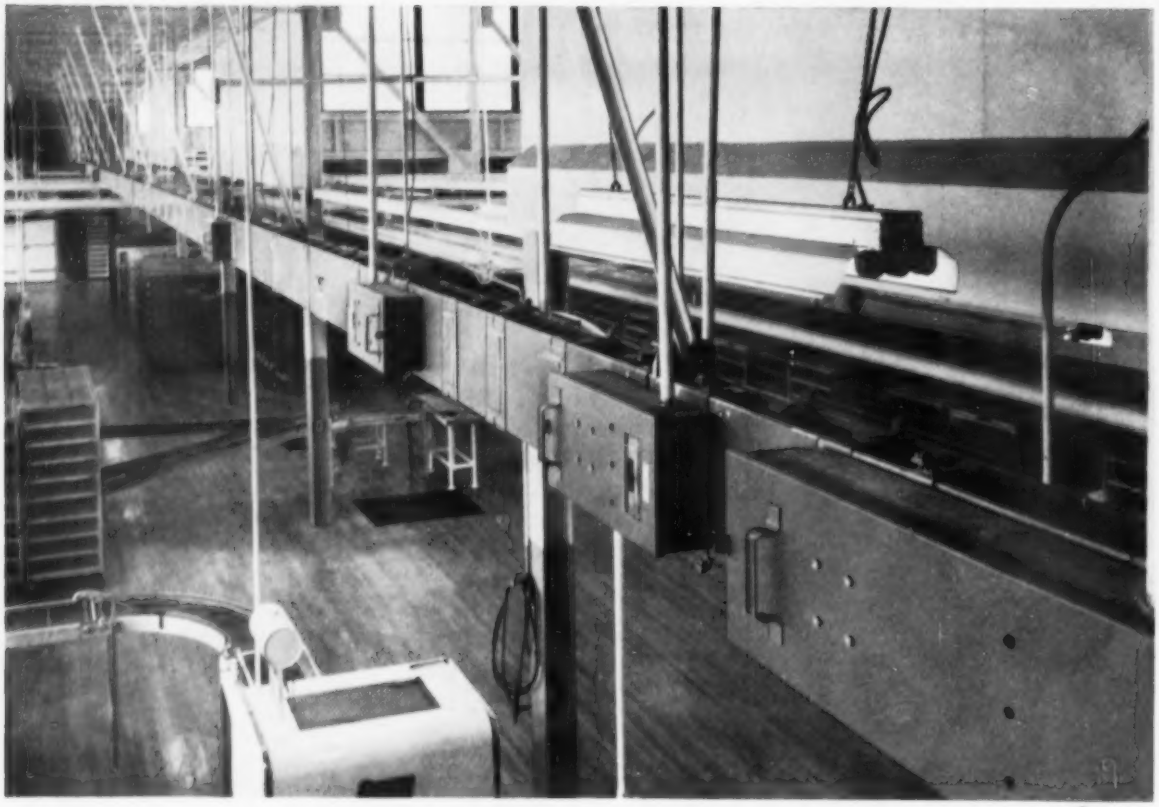
Think of having an experienced team coordinate delivery of such apparatus to meet *your* construction schedules. The team consists of . . . local distributor . . . Westinghouse field engineer . . . factory specialist. A similar team will score for you, too, in getting what you need electrically, WHEN and AS specified.

That's why we call the Westinghouse Distributor "Mr. Plus." He *does* give you something the ordinary electrical distributor can not. DP-5034-A

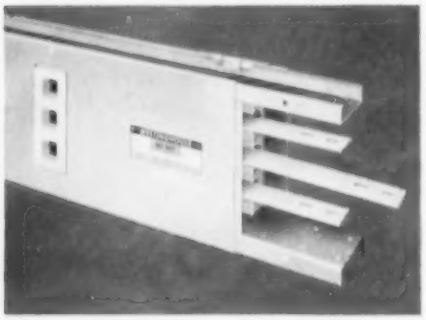
YOU CAN BE SURE...IF IT'S

Westinghouse

Mr. Plus . . .
your Westinghouse Distributor



Safe and cool as an air duct, yet you "tap" its power wherever needed



Westinghouse plug-in bus duct offers many advantages in light weight, ease of handling. Available with copper or aluminum bus bars.

The American Bakeries installation is typical of the extra utility you get when Westinghouse plug-in bus duct is used. Lots of power is needed here . . . for mixers, conveyors and, most of all, the many baking ovens.

Wherever plant layout called for spotting a piece of equipment . . . there power was quickly tapped. Convenient plug-in units, with protective devices, attached easily to the duct. When changes are needed, plug-in units can be added without shut down yet with complete safety.

DP-5034-B

YOU CAN BE SURE...IF IT'S

Westinghouse

Westinghouse panelboards save you many a (Maintenance / Construction) "headache"

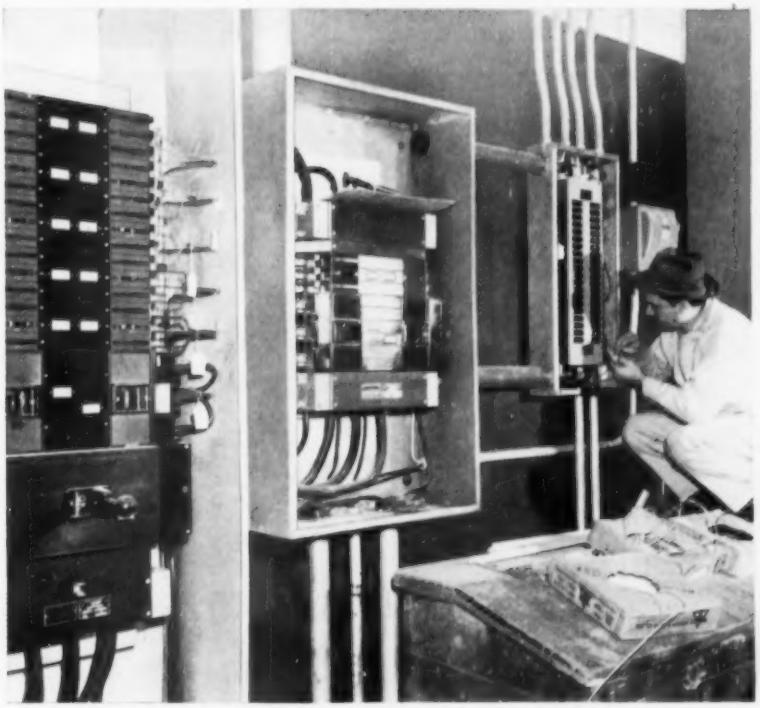
Whether your concern is installation of a distribution system or living with it forever after, you can prove that Westinghouse panelboards and switchboards can make life easier.

They are factory assembled, in units fitted to your specific needs. When they arrive on the job they *do* fit. The contractor is not left fussing and fuming to get the job done.

When they are in, that's that. Everything on the line, and those who handle it, are guarded by the types of protective devices best suited to the job in hand. They will last as long as the building in which they are installed, because that's the way Westinghouse engineers them.

DP-5034-C

Buy everything electrical from MR. PLUS . . . your Westinghouse Distributor



The Westinghouse Building-Type distribution switchboard below can be adapted to many combinations of power requirements, and expanded to any capacity with standardized units.

At left, a power distribution panel and a lighting panelboard, typical of Westinghouse equipment in the American Bakeries plant. Ask for bulletins on Westinghouse panelboards or switchboards.

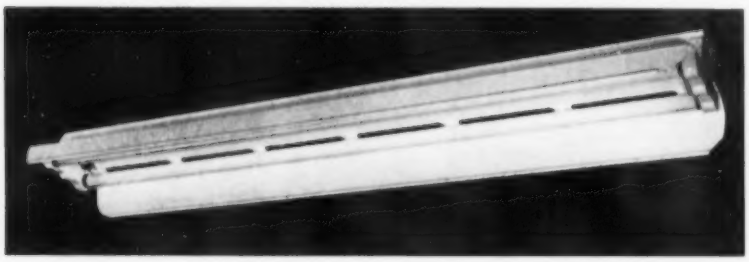
"Invisible" benefits help to make Westinghouse lighting pay for itself

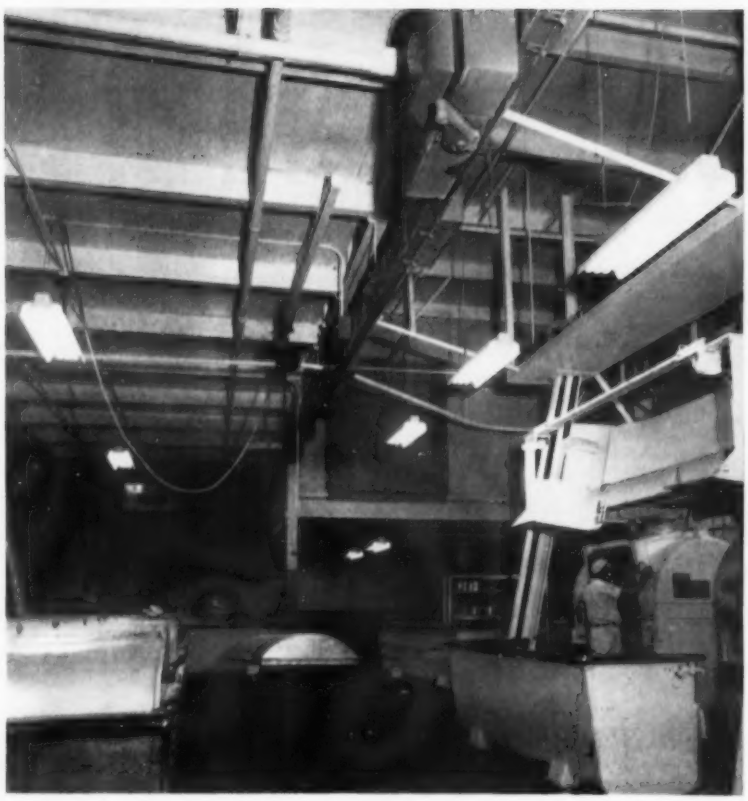
There is more to good lighting than meets the eye.

To the construction man, there's the question of fixtures that can be handled and installed without excessive damage. And the matter of installation as units or continuous troughs . . . ease of hanging.

Maintenance men want durability, ease of cleaning or replacing lighting elements . . . long life. Along with it all, of course, everyone wants the highest level of lighting for safety and fast production.

Westinghouse fluorescent lighting has proved top-value on all counts in thousands of commercial, industrial and institutional jobs. Ask your "Mr. PLUS" to show you the proof. DP-5034-D





Shown at right and above, Westinghouse Type LPB and RLM flourescent fixtures. Combining indirect and direct lighting, they provide high-level, evenly distributed light.
In the larger illustration, RLM type flourescent fixtures in the American Bakeries plant.

Wherever motors must "do it the hard way" install Westinghouse

In powering flour-handling equipment at the American Bakeries plant, the motor above illustrates better than a thousand words a big feature of Westinghouse power drives. This totally enclosed motor is good for years of dependable performance despite conditions that would choke an ordinary motor to death. Safe from explosion, too, if dust conditions become severe.

There are many other types of Westinghouse motors, for any kind of duty. Big point about all of them is their ability to "last forever" under severe conditions involving temperature, liquids, gas, dust or just plain hard work.

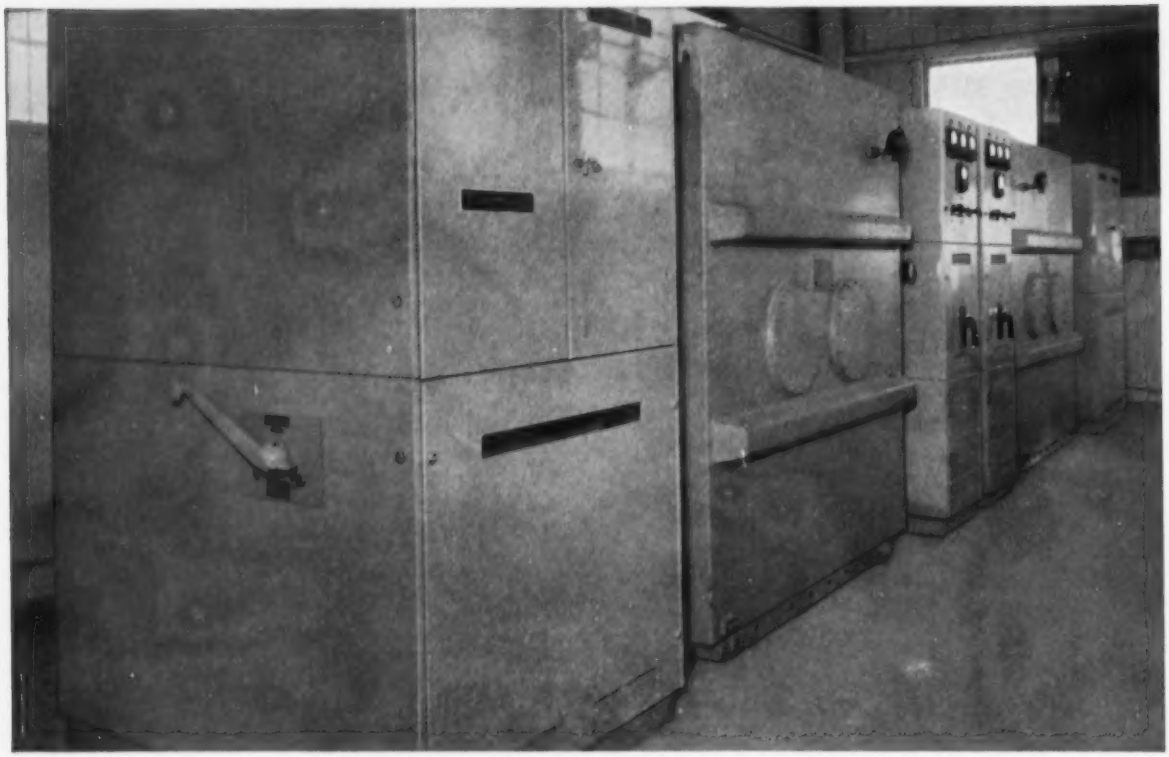
Write for motor data bulletin.

Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

DP-5034-E

YOU CAN BE SURE... IF IT'S Westinghouse

Buy everything electrical from MR. PLUS . . . your Westinghouse Distributor



Wagner Sealed Dry-Type Transformers can serve under the most adverse conditions

Impervious to DUST, LINT, HUMIDITY, HIGH AMBIENT TEMPERATURES, FLOODING—no need for vaults or barriers

Here's a unit substation transformer that you can safely install in any load center—any place—no matter how tough the operating condition.

Wagner Sealed Dry-Type Transformers are hermetically sealed in a welded steel case to provide positive protection from contamination, fire and explosion hazards.

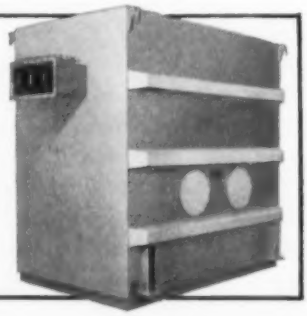
Class H insulation is used throughout the transformer. Core and coils are impregnated with silicone varnish and are sealed in the case which contains inert-dry-nitrogen under pressure to prolong insulation life. Maintenance is reduced to periodic checking of bushings case and gas pressure.

Available in ratings from 300 to 2000 kva, 5 or 15 KV high voltage, 480 volts low voltage. For complete information on these sealed dry-type transformers, write for Bulletin TU-214 or call the Wagner branch office near you.

PREDESIGNED

to save you money

Wagner Nitrogen-Filled Dry-Type Transformers save you individual job engineering time and cost. That's because they are PRE-DESIGNED in standard ratings coordinated with the specifications of unit substation switchgear builders. These standard designs assure quicker delivery of the correct transformer for your load center installation.



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SERVING INDUSTRY SINCE 1891

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Wagner Electric Corporation
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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Motor Shops

Scheduling Board Is NISA Prize Winner

First prize in NISA's 1956-7 "shop idea" contest was presented to George E. Adams, Sandman Electric Co., Boston, Mass., at the Association's annual convention, held this year in the city of Buffalo, N. Y.

The entry by Adams was a scheduling board, consisting of a plywood panel equipped with a narrow shelf at the bottom and with a grooved lip at either side to contain a series of cardboard strips. These strips contain a wealth of information pertaining to motors being repaired in the shop and as a motor begins its normal routing through the repair department, its corresponding "status strip" is placed at the bottom of the schedule board.

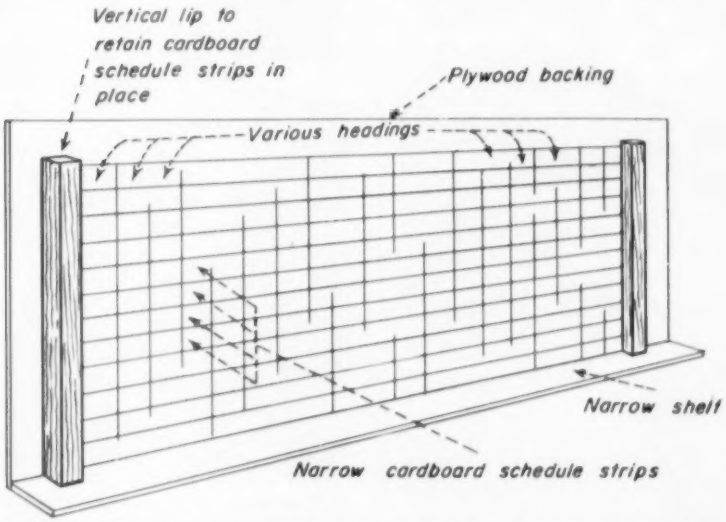
Each strip contains numerous columns, designated at the top of the board for Job Number, Date Received, Date Promised, Rewind, Strip, Coils Wound, Machine Work, Number of Dips, Overhaul Parts, Additional Repairs, Parts Required, On Order, Received, Assembled, Tested, Ready and Delivered.

As each successive repair operation is completed, the worker places his time-clock number in the respective column, together with whatever additional pertinent information is necessary to note additional work (other than that originally estimated) or parts on order, required to complete a job.

This arrangement presents a constant visual record of the status of all jobs being handled at any specific time, and, if a customer phones to inquire when his motor will be ready, a glance at the board will quickly indicate how far a motor has progressed in its trip through the shop, how many more operations are required to complete the work, or the reason for a delayed delivery.

As motors progress through the shop, the information contained on the related "status strips" naturally becomes more complete, and, when all work has been finished, the corresponding strip is removed from the board. By that time the strip has worked its way up to, or near to, the top of the board (while new status strips have been inserted at the bottom), so a quick indication of a job's approximate progress can be obtained by noting its relative position among the tierred strips.

This board is simple in design and construction, yet its purpose is practical and useful, and its adoption in the Sandman shop has eliminated the element of uncertainty which sometimes clouded the exact status of a repair job in progress. The small amount of time and effort required to insert status strips and record the information called for is amply repaid by the positive data which the board provides, and, upon receiving prompt and complete answers to their inquiries, many satisfied customers have voiced the opinion that "it's a pleasure to do business with a company that knows what it's doing".



SERIES OF HORIZONTAL STRIPS, containing wealth of practical information concerning motors being routed through successive repair procedures, provide visual checks on the temporal status of all motors. Strips are prevented from slipping out of place by bottom shelf and vertical side lips, and they are removed from the board when the related repair cycle has been completed.

Elevator Repair Is Profitable Motor Shop Side Line

Buckley Electric Motor Service in Atlantic City, N. J., formerly repaired elevator motors and controllers as a side line. But jobs well done have a habit of promoting additional business, so the side line soon expanded to the point where Buckley now handles 125 buildings through monthly contracts, and repairs many additional machines on an emergency or "when-necessary" basis. The expansion also dictated the establishment of a separate department in the shop, and this still-growing enterprise already merits separate bookkeeping, a separate stockroom, separate shop facilities, a separate name—Buckley's Elevator Service—and a separate manager, Bob Birney, who is a partner of the firm. One thinks of Atlantic City as a concentration of hotels, and many of these buildings are on Buckley's customer sheet. Also served are numerous office buildings, however, and several good-sized hospitals subscribe to the company's services.

Repairs are made at the jobsite whenever possible, for this eliminates the necessity for removing a motor or controller from a penthouse or top-of-shaft location, transporting it to the shop for repairs, returning and reinstalling it in place. Where removal is indicated, however, Buckley urges replacing a unit on an exchange basis; that is, replacing the faulty motor with one of similar size and characteristics which has previously been repaired and placed in stock

STURDI-BUILT

CABLE SUPPORT SYSTEMS

Always "A FEW STEPS AHEAD"

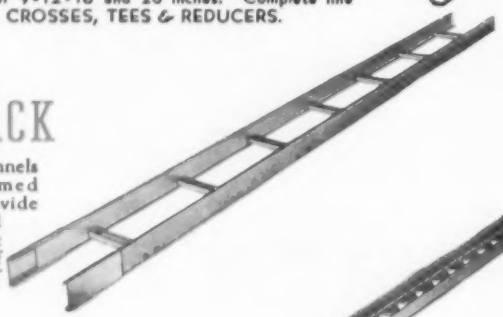
for faster

INSTALLATIONS

● **Designed for Interlocked Armor Cable, Type RH Cable and Process Tubing. Available in either STEEL or ALUMINUM. Standard widths of 9-12-16 and 20 inches. Complete line embraces BENDS, CROSSES, TEES & REDUCERS.**

CABLERACK

- Three inch Channels and Radius Formed Cross Rungs provide rigid, economical means of support for all types of Cables plus NEAT APPEARANCE.



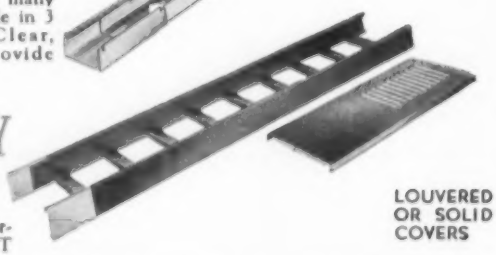
CABLETROUGH

- Primarily designed for support of one large or many small cables. Available in 3 and 4 inch widths. Clear, square openings provide ample ventilation.

CABLETRAY

WITH OR WITHOUT COVERS

- Quickly gaining popularity-The STURDI-BUILT Cabletray gives the answer to many RH Cable and Process Piping distribution problems.



LOUVERED OR SOLID COVERS

All Sections and Fittings include the popular . . .

STURDI-BUILT PAT. APP. FOR

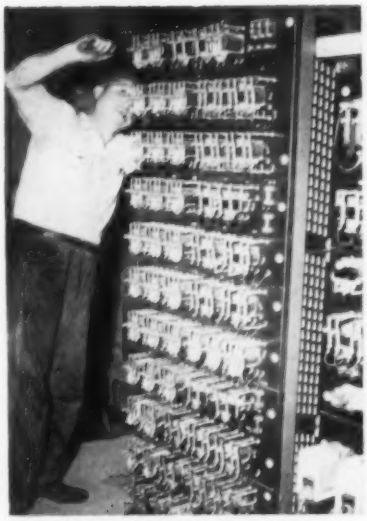
SPLICE PLATE

NO BOLTS • NO NUTS
NO WASHERS • NO PINS

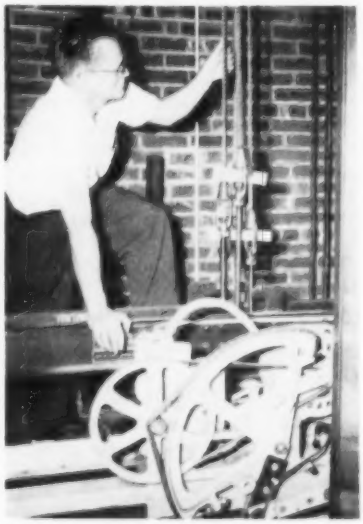
WRITE FOR OUR No. 102 CATALOGUE

The CHALFANT PRODUCTS COMPANY, Inc.

11525 Madison Avenue DEPT. B Cleveland 2, Ohio



CONTROL PANEL is included in inspection and maintenance contract, with adjustments, lubrication, cleaning and replacement of small parts included in the monthly service charge.



CABLES are checked for broken or worn wires, proper lubrication, equalized tension, alignment and connection to terminal thimbles. Buckley has 125 contracts on file.

for such an emergency. When replacements are installed, shut-down periods are shortened, a second trip to the customer's premises to replace his own motor is unnecessary, man-hours are materially reduced and bills are gratifyingly less. Buckley tries to have at least one spare unit in stock for every type of motor in service on the customers' premises, and this feature is thoroughly appreciated by those served.

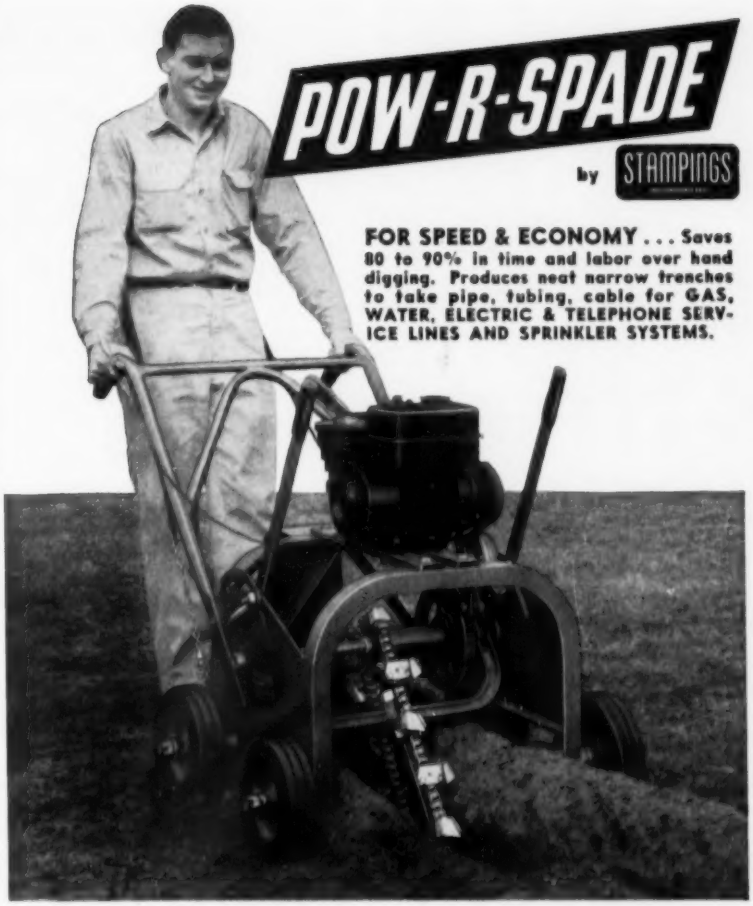
Most of the monthly contracts cover periodic inspection, oiling,

CAR IS DROPPED until top of cab is level with door landing, thereby permitting mechanic to work on top of cab with maximum ease and convenience. Regular maintenance is strong argument in favor of eliminating emergency shutdowns due to development of undetected "minor" trouble.

greasing, adjustments, small parts and 24-hour call-back service in case of emergencies. Intervals between inspections vary with size, type and service of the car in question, most inspections being either monthly or bi-monthly.

This operation, once considered only a side line, now also covers the sale and installation of new equipment and complete elevator assemblies, including guide rails and beams, counterweights and cars, doors and controls, cables and motors.

BILL JENKINS, A-C Supply Company, Akron, Ohio, and Jack Keck, Keck Electric Corporation, Joliet, Ill., found that the motor repair business has a bright future, according to numerous speakers at NISA's annual convention, held this year in Buffalo.



FOR SPEED & ECONOMY . . . Saves 80 to 90% in time and labor over hand digging. Produces neat narrow trenches to take pipe, tubing, cable for GAS, WATER, ELECTRIC & TELEPHONE SERVICE LINES AND SPRINKLER SYSTEMS.

POW-R-SPADE reduces man-hours to minutes!

Dirt is delivered finely pulverized. Easy to backfill.

A POW-R-SPADE user reports that one man and the POW-R-SPADE digs a trench in 40 minutes which under same conditions required 2 men 8 hours with hand spades. POW-R-SPADE is field tested and enthusiastically approved by hundreds of users.

POW-R-SPADE digs a neat 3 in. wide trench to any depth from 1 in. to 24 in. Operated by one man from start to finish. This machine digs right up to foundation of buildings. No complicated set-up required. No ugly scars or wheel marks to mar lawns.

Powered by well known gas engine. Safe and economical. Rugged construction. Oil sealed bearings, minimum maintenance. Shipped assembled, ready to go to work. Mail coupon for details.

A PRODUCT OF STAMPINGS **DAVENPORT, IOWA**

Portable from job to job—easily loaded and unloaded by one man.

Stampings, Inc. 1017½ Mound St., Davenport, Ia.

Please send material on POW-R-SPADE to:

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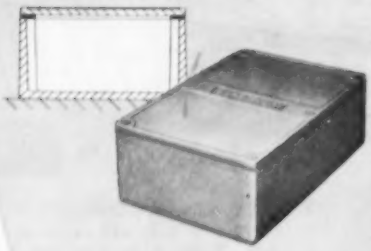
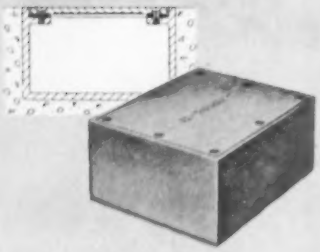
COMPANY _____

STREET _____

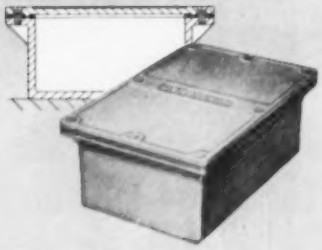
CITY _____ STATE _____



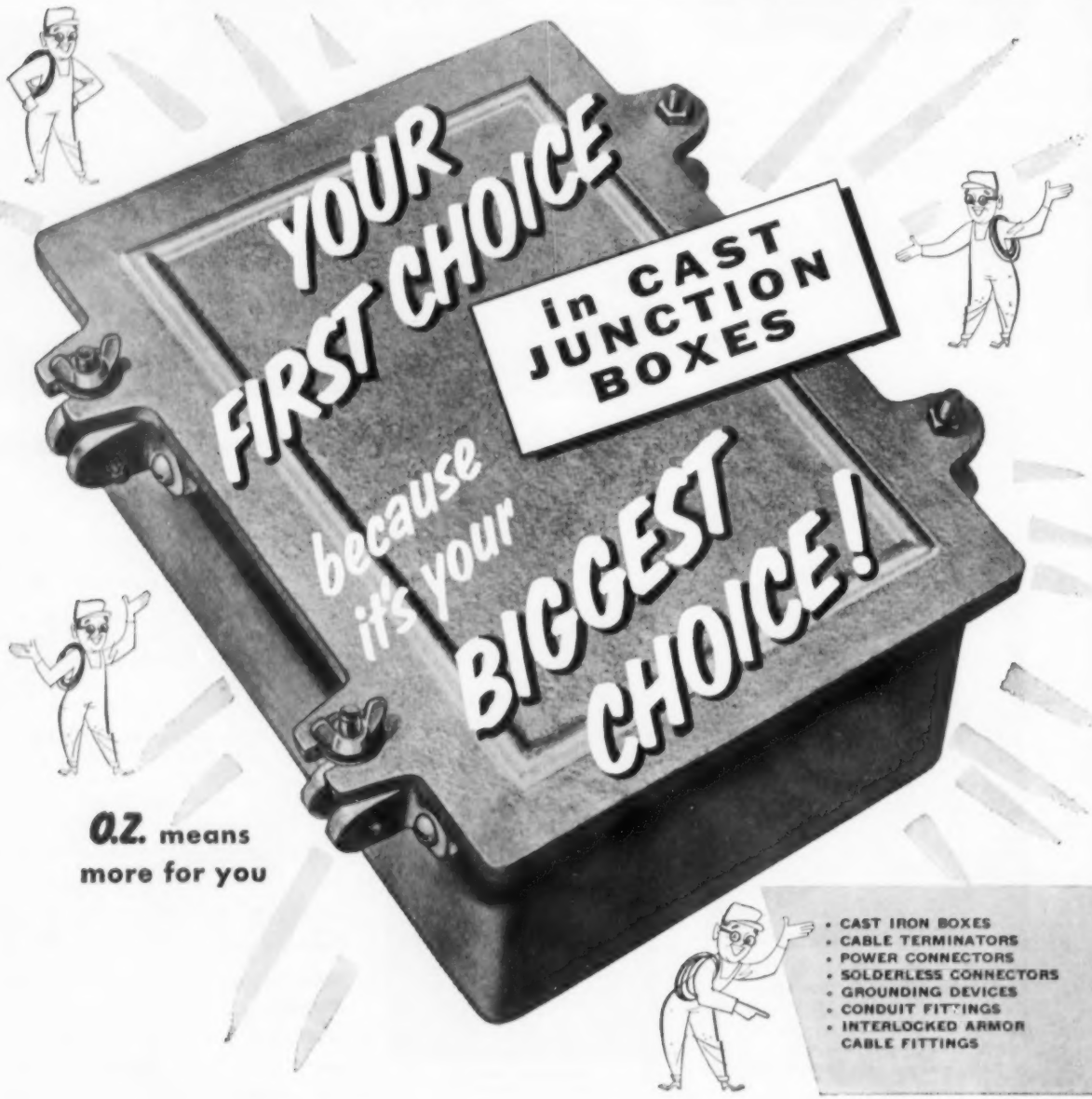
Type "YS" This unit is unflanged for surface mounting, and it is Dust-Tight and Weatherproof. The simplest in design of all the Cast Iron Boxes in the broad O. Z. line, the Type "YS" is also the most popular and the most widely used. UL approved. 133 sizes.



Type "YU" A Recessed Cover Junction Box, the Type "YU" is designed especially for flush mounting in masonry. Weatherproof and Dust-Tight, the box has an inside flange and recessed cover. UL approved. 43 sizes.

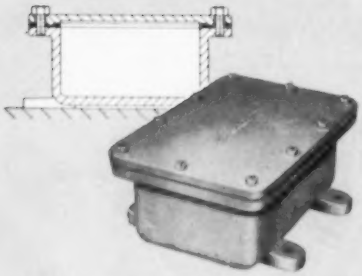


Type "YF" UL approved as Raintight, the "YF" is Watertight and submersible under a 20 foot head of water. Designed for outdoor use, this unit is recommended wherever a watertight installation is required. 78 sizes.

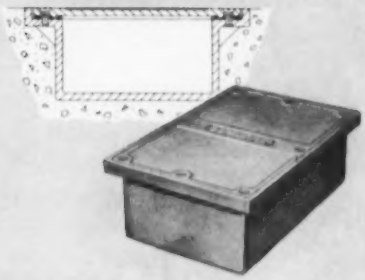


O.Z. means more for you

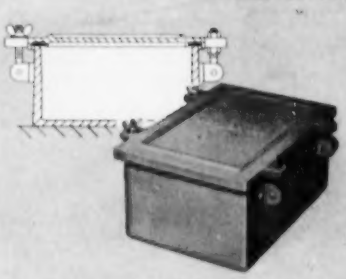
- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS



Type "YH" This is a heavy duty box, with extra-thick walls. It is listed by the Underwriters' Laboratories, Inc., as Raintight. Type "YH" boxes are submersible under a 50 foot head of water. 80 sizes.



Type "YR" An outside flanged recessed cover box, approved by the Underwriters' Laboratories, Inc., as Raintight, the Type "YR" is designed for flush mounting in walls or floors. 45 sizes.

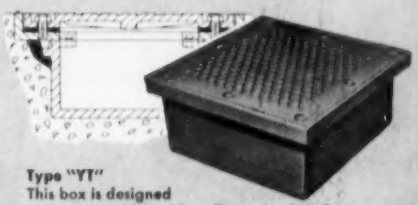


Type "YW" A hinged cover box, the Type "YW" makes an ideal enclosure where equipment within the box must be inspected frequently and easy access is required. This unit has been approved as Raintight by Underwriters' Laboratories, Inc. 110 sizes.

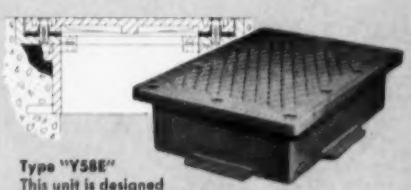
O.Z. gives you 10 types–678 sizes to choose from!

O. Z. Junction Boxes are built in such a wide, wide range of types and sizes that they meet almost unlimited *standard* requirements! In addition, all O. Z. Junction Boxes can be supplied with modifications that meet *your* specific applications exactly. Materials, conduit entrances, and mounting lug locations all may be varied. Yet, no matter how you order, O. Z. Junction Boxes embody—in design, in detail, in materials, in workmanship—the high standards of quality characteristic of *all* O. Z. products. Next time you need junction boxes, take advantage of the largest selection available in the industry! Make O. Z. your first choice ...It's your biggest choice!

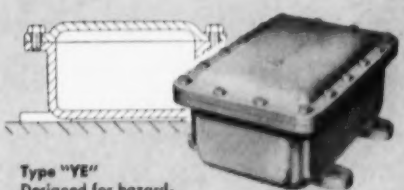
Call your local O. Z. distributor, or write direct to the company for complete information.



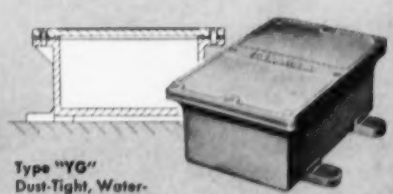
Type "YT"
This box is designed to be mounted in sidewalks and other flat concrete surfaces. The checkered cover has reenforcing ribs and is made to withstand pedestrian and light vehicular traffic. 33 sizes.



Type "Y58E"
This unit is designed to top off an underlying concrete pull box. The flange and cover can be replaced without disturbing the box the same as the Type "YT". 5 sizes.



Type "YE"
Designed for hazardous locations, Class I, Group D. Type "YE" boxes are Explosion-Proof, Dust-Tight, and Weatherproof. All joints are of the metal to metal type, ground to exceptionally close tolerances. 80 sizes.



Type "YG"
Dust-Tight, Watertight. For hazardous locations, Class II, Groups E, F, and G, covering atmospheres containing metal dust, carbon black, coal or coke dust, and grain dust. 76 sizes.

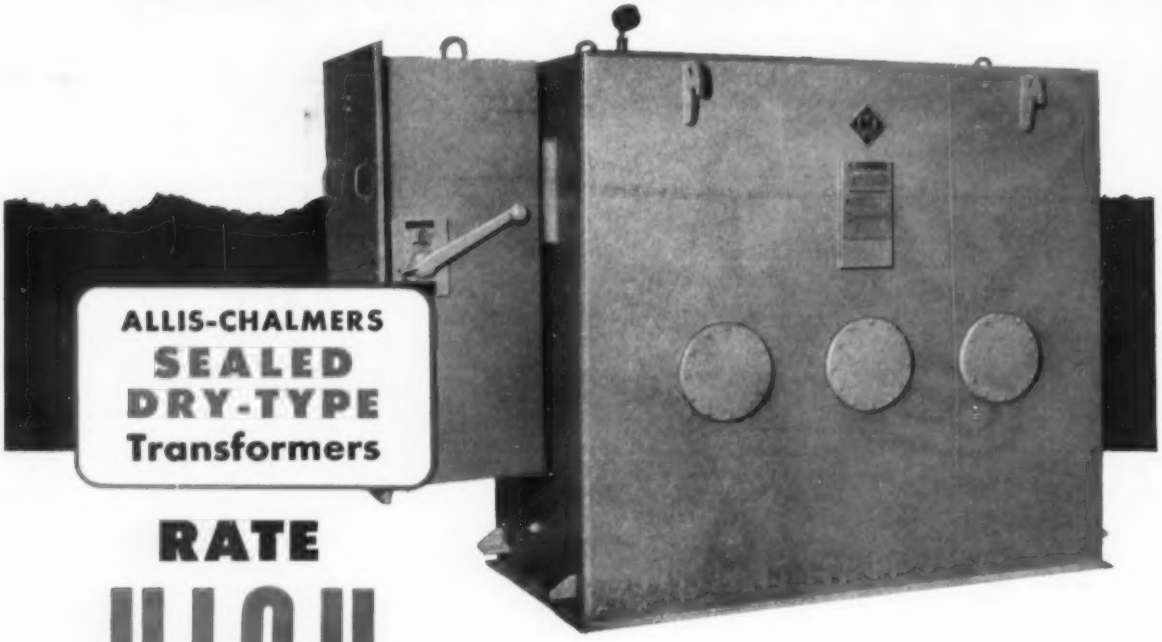
O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

We asked utilities and industrial users:

"What type transformer do you prefer for plant service, station auxiliary and load-center applications?" Sealed dry-type units rated number one in five basic categories of operation and operational cost. For all the facts, see your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



RATE HIGH

with Operators ...ON EVERY COUNT

	Sealed Dry Type	Open Dry Type	Askarel Filled	Oil Filled
INSTALLATION COST	1	3	2	4
LOCATION VERSATILITY	1	2	3	4
SAFETY	1	3	2	4
RELIABILITY	1	2	1	1
MAINTENANCE	1	3	2	2

Types rated in order of Preference

- **Installation Costs**—Your Allis-Chalmers sealed dry-type transformer is ready to be energized immediately upon shipment, or may be stored indefinitely until needed.
- **Location Versatility** — It can be located indoors or outdoors, overhead or underground — in flood areas, dirty and contaminated atmospheres — no special precautions need be taken.
- **Safety** — No fire or explosion hazard. Transformer unit is hermetically sealed in inert dry nitrogen gas.
- **Reliability**—Performance is unparalleled. Contaminants and moisture cannot enter case to affect service. Oxidation of insulation materials cannot take place.
- **Maintenance**—Upkeep is virtually eliminated. No liquids to maintain. No need for periodic cleanout of core and coil. Plain tank shell is easy to paint.

ALLIS-CHALMERS

A-5328

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Product News

Fire Warning System (1)

Zonalarm, a specially designed fire alarm system to meet the needs of large homes, farms, small businesses, stores, super-markets, motels and semi-commercial buildings, has been announced. The system is a completely automatic fire warning and locating unit.

It is adaptable to new construction and modernization of older dwellings or business establishments. Zonalarm is flexible enough for a wide variety of applications, thus filling the gap between the home fire alarm and more elaborate units for large industrial and institutional structures.

Standard equipment includes a power unit, indicator panel, a bell housed in the main panel, an interior extension bell and heat detectors. The UL listed detectors are 2-in. in diameter, completely automatic, self-contained and self-restoring. They are located on ceilings of all fire-hazard areas, and are simply installed by attaching hidden or surface lead-in wires to terminals and mounting detectors to the ceilings.

The system goes into operation when fire starts or heat rises, closing thermostatic detectors. This warning signal is transmitted to a centrally located, attractively designed indicator panel with four lucite windows. Each window panel represents a separate zone, protected by one or a series of detectors. Where building layout requires more than four zones to be protected, several indicator panels can be mounted side by side in tandem.

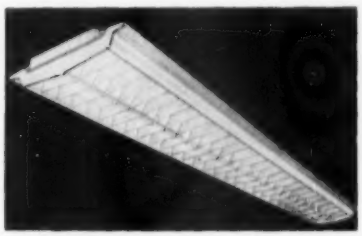
The power unit, containing a UL listed transformer, relays, wire terminals and a battery compartment, supplies low-voltage power to the system from standard 115-volt current. The system will automatically switch to battery operation should power failure occur, causing a "battery-on" lamp to light on the indicator panel. The system also switches back automatically when power is restored. The system has sufficient capacity to light the indicator panel, sound alarm bell in the panel, sound extension alarm and activate relays for auxiliary signal circuits.

Edwards Company, Inc., 90 Connecticut Ave., Norwalk, Conn.

Steel Joists (2)

Advantages of underfloor electrification and open-web steel joists are combined in a new type of steel joist. Electro-Channel joist is essentially a short-span open-web steel joist with the conventional top chord replaced by a hollow duct. This serves both as a structural member and as an underfloor electrical distribution duct. Wiring can be brought up through the floor at any point along the joist where an outlet is needed. When joists are erected, a smooth passageway for wiring exists the full length of the building. Service fittings for electrical outlets can be tapped into the E/C joists at any desired point. These fittings are tapped directly into the top of the joist duct. Standard heater ducts are also used in the same way. UL have approved E/C joists for use with the standard header ducts, service fittings and other electrical accessories as marketed by General Electric, National Electric Products, and Walker Brothers.

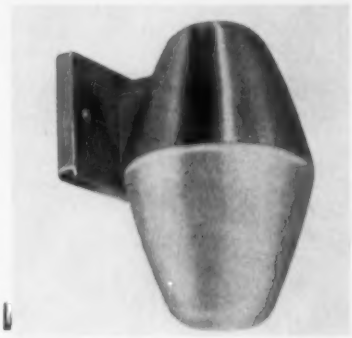
Ceco Steel Products Corp., 5601 West 26th St., Chicago 50, Ill.



Lighting Fixtures (3)

New lighting series, the Parawing, Parawing Ultra, and Paralume, are commercial fixtures with translucent polystyrene sides extruded in one piece for either 4- or 8-ft units. Design blends fixture into the ceiling. Parawing has a baked-white interlocked louver assembly, and is available in 2-lamp, 4-ft rapid-start; 4-lamp, 4-ft rapid-start; 2-lamp, 8-ft slimline and tandem 8-ft rapid start. Parawing Ultra also furnished in 4- and 8-ft 2-lamp units, is equipped with aluminum Paralouvers, Paralume, furnished without lateral louvers, has a center V-louver which provides 35° lateral cut-off.

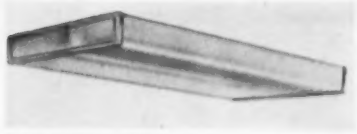
Day-Brite Lighting, Inc., 16 N. 9th St., St. Louis, Mo.



Lighting Fixture (4)

A new commercial wall-bracket lighting fixture of die-cast aluminum, designed for either interior or exterior installation. Screw-in white opal enclosing globes of uniform color density are made weatherproof by cork gaskets. Each globe accommodates a 150-watt lamp. Lights may be adjusted to positions to suit various architectural applications and may be mounted side by side or one on top of the other. Fixtures are supplied in standard finishes of satin chrome or gloss gray, or in colors. Called WB-125-2, unit fits either 3½-in. or 4-in. outlet box. Fixture is also available as a single unit, Cat. No. WB-125.

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley, Calif.



Fluorescent Fixture (5)

A shallow completely shielded luminous fluorescent fixture, called the Quentin. The wrap-around plastic enclosure of "Everwhite" ultraviolet resistant polystyrene provides lighting of high efficiency with low brightness. Unit is 3¾ in. deep, and can be surface or pendent mounted. Choice of 24-, 48- and 96-in. lengths with 9¾- and 12-in. widths for two and four lamps. May be mounted individually or in rows or patterns. Plastic enclosure hinged from both sides is removable.

Fullerton Manufacturing Corp., Willard Road, Norwalk, Conn.

BUY 'EM BY THE POLYETHYLENE BAG!!

A *Merchandising* FIRST!

A new MIDWEST concept in packaging locknuts

Midwest introduces locknuts packaged in tough, thoroughly-tested, heavy gauge, heat-sealed, polyethylene bags:

- 100 locknuts per bag
- 5 bags per carton (500 locknuts)
- 5 ctns per standard package (2500 locknuts)

- ***EASY TO CARRY***
- ***EASY TO SEE***
- ***CONVENIENT TO STOCK***
- ***CONVENIENT CONTAINER ON THE JOB***

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

Chicago 12, Illinois

Transformer (6)

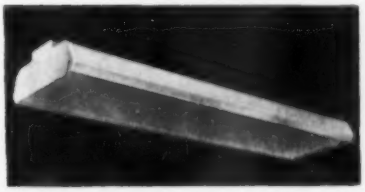
A new low-noise-level dry-type single-phase distribution transformer, type DS-3. Single-phase ratings are from 25 through 167 kva. Three-phase ratings are from 45 through 300 kva. These designs are available in the 600- and 5000-volt insulation classes. Unit uses a basically inorganic insulation system, including silicone varnishes, and is designed for 150 degrees C temperature rise. All terminal boards and cable connections are in a compartment located at bottom of transformer where low-temperature conductors can be used since air in this area is at ambient temperature.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Feed-In Duct (7)

A new line of totally enclosed aluminum feed-in duct that does not require derating. Standard construction of the busway meets NEC article 3644 ". . . busways may extend vertically through dry floors if totally enclosed (unventilated). . . ." This totally enclosed feature is accomplished by separating and enclosing the aluminum bus bars in solid sheets of insulating material. Telescoping joints that permit infinite adjustability up to 12 in. are used to eliminate the need for special odd lengths. By using standard 3, 5, 7 and 10-ft straight lengths with one or two telescoping joints, it is possible to obtain any dimension needed without special fittings and delivery delays. Telescoping joints permit last minute dimensional changes to be made while installing the duct. Elbows, tees, crosses, offsets and switchboard stubs are adjustable through a 6-in. range. All joints are symmetrical, have outward facing captive carriage-type bolts. Cable tap boxes are equipped with aluminum lugs that accept either copper or aluminum cable. The duct is available in all standard ratings from 600 to 4,000 amps —2-, 3- and 4-pole.

Square D Company, 6060 Rivard St., Detroit 11, Mich.



Lighting Fixtures (8)

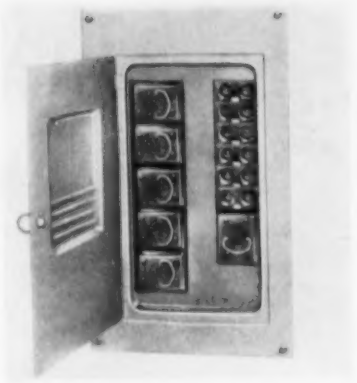
New Futurliter fluorescent fixture features the "flexible footcandle package." Luminaire is adaptable for 100% downlighting, or combination up and down lighting. Units are available with Gratelite louver diffuser, metal cross baffles with either 35° by 25° or 35° by 45° lamp shielding, low brightness lenses, ribbed Albalite and ribbed Skytex glass bottoms. A complete range of units in 4-ft or 8-ft lengths, rapid start or slimline series are available.

Edwin F. Guth Company, 2615 Washington Blvd., St. Louis 3, Mo.

Oven (9)

A standard portable bench oven, called Model TD, with eight drawers to permit processing of different materials at the same time. Oven is practical for parts or materials that require pre-heating, drying or baking in temperatures to 325°F. Temperature is adjustable and controlled by thermostat. Plugs into 110-volt ac outlet, 2400 watts. Featured is forced air circulation by electric motor driven fan; adjustable damper controls volume of air circulation. Outside dimensions 30 in. wide by 25 in. deep by 24 in. high. Inside 28½ in. wide by 24 in. deep by 20½ in. high. Eight drawers of expanded metal 2 in. high by 11½ in. wide by 23 in. deep.

Grieve-Hendry Co., Inc., 1401 W. Carroll Ave., Chicago 7, Ill.



Main and Range Panel

A new 150-amp parallel-connected main and range panel designed for use in the meter-switch-fuse sequence for 120/240-volt, 3-wire, single-phase service. Device provides six 240-volt parallel connected pullouts with 12 plug fuse branches, and is UL approved for entrance and loadside service where a main disconnect is not required. Available in general purpose enclosures for either flush or surface mounting, the unit features completely dead front construction, reversible puller heads with patented pressure contacts and a step-type solderless lug neutral. Flush units are designed for use in dry wall construction or for between stud mounting on 16-in. centers.

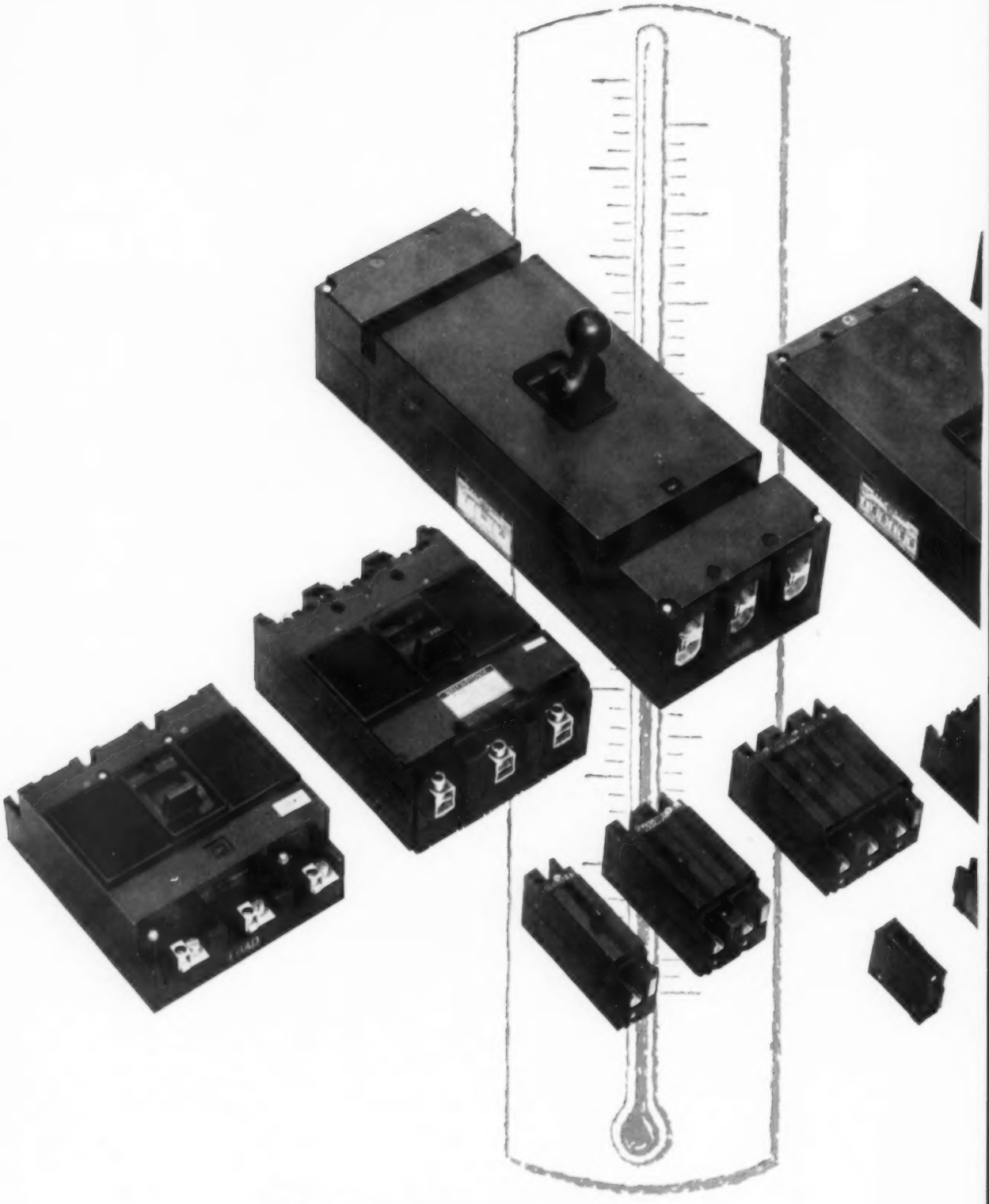
Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.

Fluorescent Unit (11)

A new shallow fluorescent lighting fixture called the Civic. It is 3⅞ in. in depth and is designed for 100% downlighting. It can be used with two or four rapid start Bi-Pin lamps. Available with Corning Pattern No. 70 glass or acrylic plastic shielding. Installation may be individual or in continuous rows, with connectors provided. The shielding is contained in the extruded aluminum frame, which forms the sides and ends of the unit, and opens from either side by lifting the frame, which swings down and hinges from either side.

Smithcraft Lighting, Chelsea 50, Mass.

The only complete line of



ambient compensated breakers...

Westinghouse

Whenever circuit breakers are subject to wide ambient temperature variations to which associated conductors are not exposed, an ambient compensated type of breaker should be specified. This provides added insurance against current interruptions due to false high-temperature influences. The net effect is to prevent the breaker from unnecessarily derating the conductors.

Typical of the conditions under which ambient compensation may be required are . . .

In panelboards or load centers where a large number of closely grouped breakers create high temperatures.

Proximity of breaker installation to other equipment causing ambient variations to which the conductors are not exposed.

Westinghouse has the only complete line of circuit breakers to meet every requirement. (1) "Compensated for enclosure ambient," standard in Quicklag® breakers, (2) "Noncompensated for ambient re-rating," standard in Types E through M, (3) "Ambient compensated," by specification in Types E through M.

The engineering "know-how" which goes into the development of this reliable protective equipment is available to aid you in selection of the right type of breaker for your particular circuit conditions. Ask for Westinghouse Bulletin 7221 detailing technical information on the choice of circuit breakers.

J-30277

Get proper breaker protection under all ambient conditions.

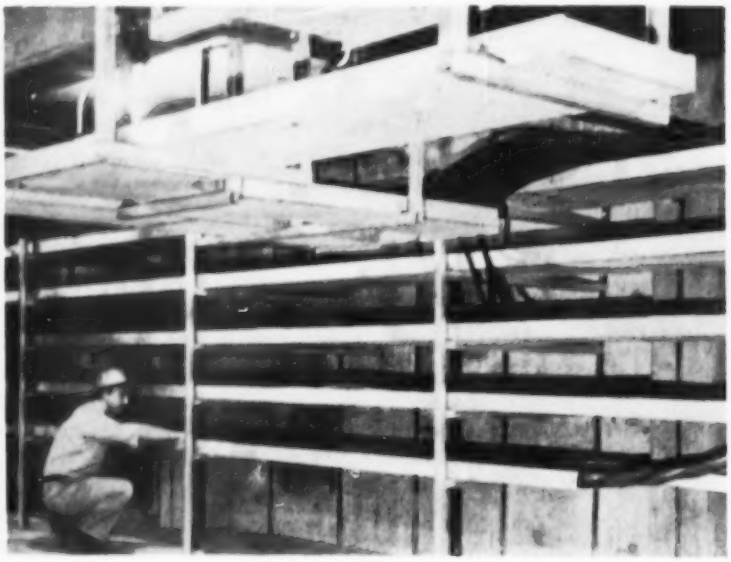
YOU CAN BE **SURE**... IF IT'S

Westinghouse

Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania

SUPPORTS FOR CABLE AND TUBING PASS "THE ACID TEST"—

THE APPROVAL OF DESIGNERS, CUSTOMERS, AND USERS WHO SAY: "Well laid out and engineered." Nicer and sturdier." "Quick and easy to install." "Boy, does that ladder look good!" "We're ordering more." "For my money, I'll take P-W Supports anytime." "Thanks, for good delivery."



P-W offers the latest in support systems—expanded metal, ladder, or solid—which are interchangeable as required. Comes in 3″, 6″, 9″, 12″, 18″, and 24″ widths, in 1′ multiples from 1′ to 10′, 12′ and 16′ lengths. Can be purchased in two ways: (1) in certain standard lengths, or (2) in various lengths, which, together with P-W's Extension Connectors, eliminate all field cutting. Adjustable Horizontal and Riser Connectors give the greatest flexibility and meet all changes in direction and elevation. P-W's Channel Connectors, with drive rivets, provide not only a quick connection but good electrical continuity.

Our pre-cut system provides the greatest savings in material and installation time—waste is eliminated and the various parts assembled without field cutting. Send us your drawings and we will take off bill of material. When order is placed, we mark up drawings or reproducibles with catalog numbers. Same numbers are placed on items at time of shipment to facilitate field erection. P-W Twist-Rack is available to support trough or ladder.

Join our evergrowing list of outstanding and satisfied customers. The first step is to write today for our catalogs. Let our engineers help you!

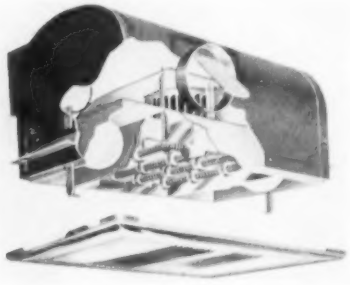
P-W INDUSTRIES, INC. Duncan & Melrose Sts., Philadelphia 24, Pa.

Representatives throughout country to serve you!

Load Center **(12)**

A new load center line featuring "plug-in" operation and split bussing. Containing from 2 to 42 breaker positions, the new line has many "easy-to-wire" features. Lay-in type connectors facilitate wiring while special "pressure pads" maintain continually tight connections —particularly effective with aluminum conductors. Boxes are available for surface or flush mounting. Other features include ample wiring room, knockouts and plated current-carrying parts, alternate polarity bussing for making 2-pole circuits. Rain-tight equipment is also available.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn, N. Y.

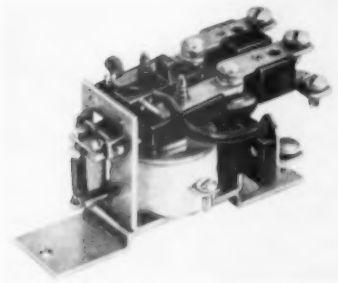


Fan-Light-Heater **(13)**

An all-purpose single-unit fan-light-heater combination. Unit consists of a housing 14 in. long by 8 in. wide by 8 in. high, designed to include the separate fan, light and heater into one unit for placement in bathroom ceiling. Heater features a 1450-watt rapid-heating chrome-nickel coil with Mirro-lux Alzak reflector that directs heat downward, providing an even distribution of heat. Fan, a squirrel cage type, whisks steam and odors away. Back drafts are prevented by an automatic damper. Light consists of two 60-watt lamps, placed on each side of unit, behind flat white-heat resistant lenses. Facing grill

is attached against ceiling by special attaching arms, yet releases easily for finger tip removal. Light, fan and heater are individually switched, and entire unit is easily removed from housing. Housing itself fits between standard ceiling joists on adjustable mounting brackets that eliminate framing-in. It also allows for variations in ceiling thicknesses up to 2 in. Only 7½ in. headroom is required above ¾-in. plaster. Unit is UL approved for rubber-covered 60° standard building wire. No. 12 leads for heater, and No. 14 for fan and light are all in one splice box for standard wall switching.

Emerson-Pryne Co., Pomona, Calif.



Relay **(14)**

A new general purpose industrial relay features interchangeable coils and removable multi-position base. Contacts rated at 20 amps, 115 volts, 60 cycle ac or 24-volt dc, are single-and-double pole, single-and-double throw. Mounting arrangements are provided for auxiliary SPDT contacts if desired. Relay is 2⅞ in. high with a base measuring 1 by 3¾ in.

Wheelock Signals, Inc., Long Branch, N. J.

Ballasts **(15)**

Three new ballasts especially designed for operation of G-E's new rapid-start circline fluorescent lamps. The 6G1090 unit will ballast one 22-watt rapid-start circline lamp. One 22-watt and one 32-watt circline lamp in series can be operated by the 6G1100 models. The 6G1110 unit ballasts one 40-watt and one 32-watt lamp in series. Designated 89G327, the modified unit which previously operated one 40-watt rapid-start circline lamp, will now also operate one 32-watt circline lamp.

General Electric Co., Schenectady 5, N. Y.

Authoritative tests show the *Red Head* Concrete Fastener in the small ¼" size withstands pull-out loads up to two tons; up to nine tons in a ⅜" size! Drills its own way into the toughest concrete in seconds . . . *and once it's in—it's in forever* because of full dovetail expansion. Will not pull out, rust out, melt out or shake loose. Costs less installed than any other type concrete fastener, too! We can demonstrate this at your job site. Write for the descriptive, illustrated catalog and free sample

PHILLIPS®
RED HEAD
CONCRETE FASTENER
self-drilling

PHILLIPS DRILL COMPANY, MICHIGAN CITY 8, INDIANA

WHY BUY LESS

...the best costs so little

CM HOISTS AND PULLERS are ruggedly constructed to give you years of trouble-free service. Yet they are unusually light...easy to handle because they are constructed of the strongest alloys of steel and aluminum. Equipped with famous CM-Alloy flexible, welded alloy steel load chain.

CM CYCLONE

- Capacities from ½ to 10 ton.
- 1-ton model weighs only 36 pounds.
- 96% efficient—easy to operate.
- Lifetime lubricated.

CM PULLER

- Capacities ¾, 1½, 3 and 6 ton.
- ¾-ton model weighs only 13 lbs.
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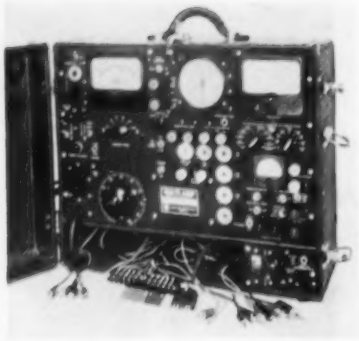
DISTRICT OFFICES: NEW YORK, CHICAGO, CLEVELAND

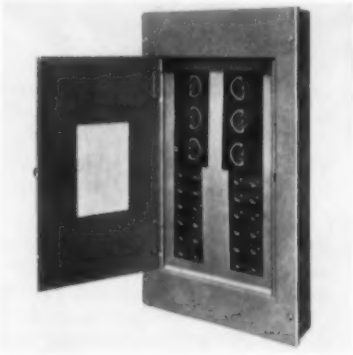
In Canada: McKinnon Columbus Chain Limited, St. Catharines, Ont.



Relay Tester (16)

A "Universal" test set, Model 61-V3-DC, is a portable self-contained instrument for field or bench testing of practically all types of protective relays. Features include two independently adjustable current sources for testing differential and directional relays, a voltage output for voltage relays, an 8-volt dc output for testing relay targets and seal-in units, a 150/300-volt dc output for miscellaneous dc relay testing, continuity indicator for contact action and continuity tests, and separate 1% ac ammeter, ac-dc voltmeter and dc ammeter. It has a continuous duty rating of 0.4 kva, with overload capacities and four high current ranges from 0-100-amp at 0.4 volt to 0-12.5-amp at 0-32 volt.

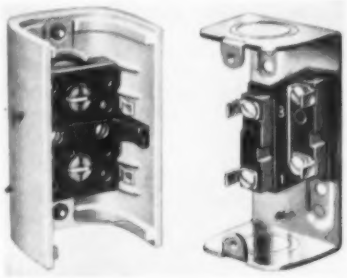
Multi-Amp Corporation, 465 Lehigh Ave., Union, N. J.



Switch (17)

A new service entrance switch that combines all home service entrance equipment in its single cabinet. Switch is especially designed with the requirements of electrically-heated homes. Switch features six branch pullouts in parallel for lighting and appliance loads and 24 plug fuse branches for lighting and heating circuits. Specifically, the pullouts accommodate lighting loads, a range of either the standard or built-in divided type, utility circuits, a water heater and dryer or an air-conditioner and built-in oven. The six-pullout switch has a 200-amp rating, and is designed for 120-240-volt ac application. Each of four pullouts is 60-amp; the remaining two are 30-amp each. The 30- and 60-amp pullouts cannot be interchanged. Models are available for either surface or flush mounting. Overall height of switch is 28 in.; width, 14¼ in.; depth 3¾ in.

American Electric Switch Division, The Clark Controller Co., Cleveland, Ohio



Switches (18)

A new line of Bulletin 800 standard duty pushbuttons and selector switches with a molded wrap-around cover which contains and protects the contact mechanism. Removing the cover exposes the wiring terminals in the base. A molded Bakelite shield covers and protects the contact mechanism when cover is removed. They are available in NEMA 1 enclosures with one, two, and three buttons, or two buttons and a pilot light. All Bulletin 800 pushbutton and selector switch contacts are of double break, silver alloy construction. The ac contact ratings are 3-amp, 110-volt; 2-amp, 220-volt; and 1 amp, 440-550-volt. The dc ratings are 1-amp, 115-volt; 0.5 amp, 230 volt; and 0.2 amp, 550-volt.

Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis.

Power Drive (19)

A new polished aluminum housing is featured on the improved No. 68 portable power drive. No. 68 is basically a worm and ring gear assembly housed in a lightweight frame and powered by a ½ hp, 110-volt motor or 90 psi air motor. Adapters can be supplied for a wide variety of rotary power applications.

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4, Ohio

Now-PERMANENT PROTECTION

for Outdoor Convenience Outlets

WEATHERPROOF ALUMINUM • NEVER RUST OR CORRODE

- Lifetime stainless steel spring and hinge pin closure — no fumbling with screw-on lids
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- For all 2-wire and 3-wire duplex receptacles

Catalog No. 1055 . . . fits FS and FD fittings, gasket and screws included.

Catalog No. 1057 . . . fits steel switch boxes. Gasket and screws included.

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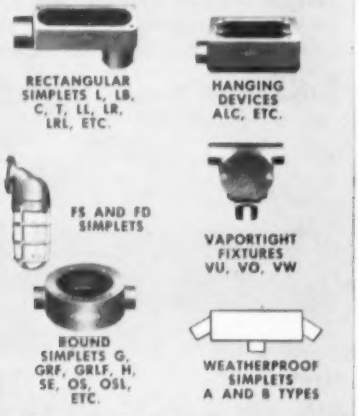
DUPLEX OUTDOOR COVERS

IDEAL-SIMPLET FITTINGS INCLUDE . . .


RECTANGULAR SIMPLETS L, LB, C, T, LL, LR, LRL, ETC.
HANGING DEVICES ALC, ETC.
FS AND FD SIMPLETS
VAPORTIGHT FIXTURES VU, VO, VW
BOUND SIMPLETS G, GRF, GRLF, H, SE, OS, OSL, ETC.
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AND MANY OTHERS—FOR COMPLETE CATALOG SEE YOUR WHOLESALER, OR SEND COUPON . . .

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Never before available . . . these *new* aluminum Ideal-Simplet Duplex Outdoor Covers are offered to help you provide *permanent* protection for outdoor convenience outlets. A service which can mean more work for you . . . more volume and income. Use Ideal-Simplet Duplex Outdoor Covers with standard Ideal-Simplet FS and FD fittings or steel switch boxes on your next job!

BY THE MAKERS OF THE FITTINGS WITH THESE OUTSTANDING FEATURES

- Fastest delivery in the industry
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- Strong, rugged, durable
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- Covers packed with LB, C, E, T, LL, LR, LRL rectangular fittings, if you prefer

ORDER IDEAL-SIMPLET DUPLEX OUTDOOR COVERS AND FITTINGS FROM YOUR WHOLESALER NOW

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PORTABLE ELECTRICAL CORDS AND CABLES
IN A RAINBOW OF COLORS...
For quick, easy identification BRONCO presents portable electrical cords and cables with colored jackets. At present a stock is maintained in a few sizes of some colors. However, in many cases, by ordering minimum production runs, customers can also have their own names branded into the jacket. Large users of wire and cable have found this an effective way to prevent pilfering.
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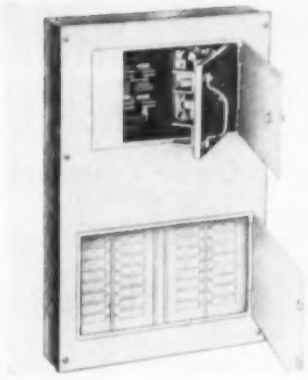
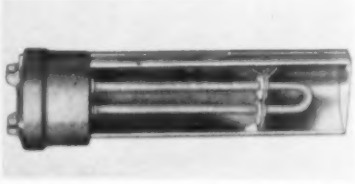


Disconnect **(20)**

A new 200-amp fusible main disconnect combines the advantages of both fuse and circuit breaker. The door operated switch controls all of the circuit breaker circuits 24 to 32. With sequence bus design any two adjacent breaker positions may be double pole. Circuit breaker branch circuits (15 to 50 amp) may be used for lights, appliances, washers, dryer, range, water heater, heating panels, air conditioners, etc. Equipped with two doors, one covers the 200 amp main, door operated switch, and the other the branch circuit, circuit breakers. Switch is wired to circuit breaker bus bars. Line terminal, neutral and fusible block are equipped with solderless wire connectors and has a solid groundable neutral. Circuit breaker bus bar assembly is attached to an easy removable self-aligning metal mounting plate.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.



Heaters **(21)**

A new line of liquid-tight Chromalox electric radiant heaters, designed for industrial applications in which uncontrolled heavy splashing is present or where periodic wash-down is required. Liquid-tight construction is also suitable for outdoor radiant comfort heating. Heating element is U-shaped Chromalox tubular with a rating of 94 watts per lineal inch of heated length. Element is firmly centered in a rigid extruded aluminum housing with a polished metal re-

flector. Heaters are equipped with movable clamps and are bolted to drilled holes in angle iron, steel strap or other mounting provisions. 27 standard heated lengths are available, from 8⅝ to 77⅛ in. with overall lengths from 13⅛ to 87¼ in. Standard wattages are from 800 to 7200; voltages are 120, 240 and 480.

Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.

Battery Charger **(22)**

Battery trickle charger with continuous adjustment range of 50 to 200 milliamps is now available. It includes a meter to indicate charging current; output is fused to protect charger components. Output voltages are 12 and 24 volts dc with input voltages of 110 to 120 volts, 60 cycles. Marked terminal blocks provide terminals for input and output connections. A full wave selenium rectifier circuit is provided. When required, chargers can be furnished with enclosures.

Automatic Switch Company, Florham Park, N. J.

Threader **(23)**

Using special aluminum alloy castings, the No. 41-E geared threader has been reduced in weight by about 40%. It is a fully adjustable threader for use by hand or with power drives. It uses only one set of dies for the full range of 2½-, 3-, 3½- and 4-in. The die cam may be set to cut standard, deep, or shallow threads of standard length. Both straight conduit and tapered threads can be made with the same set of dies by making a simple adjustment. It is available in either American or British right-hand threads, plus special oil field threads—10, 11½, and 14 thread pitch.

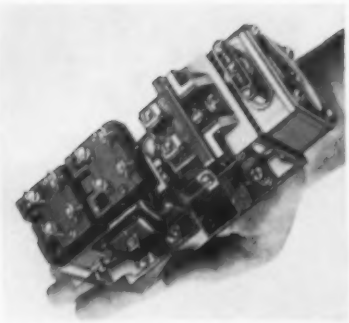
Reaver Pipe Tools, Inc., Warren, Ohio

It's the EXTRA NEOPRENE puts the BRAWN in

It's the bonus quantity of Neoprene—67.32%, certified by a registered professional engineer—in the outer protecting jacket that gives Bronco 66 Certified its extra toughness, greater resistance to oil, ozone, sunlight; makes it more flameproof, more resilient, more flexible. Jackets are branded every two feet.

Sold nationally by Electrical Wholesale Distributors.

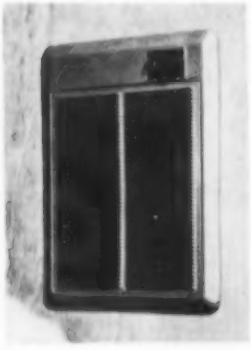
WESTERN INSULATED WIRE CO., LOS ANGELES 58, CALIFORNIA



Timing Relay **(24)**

A smaller pneumatic timing relay to meet the restricted space requirements of machine tool control panels and similar industrial applications. The narrow-base relay measures 2½ in. wide by 7⅞ in. high. It offers an adjustable timing range of 0.2 second to three minutes. The device can be quickly converted from on-delay to off-delay operation—or the reverse—in the field. The ac version, designated as Class 9050, Type B, may be used on circuits up to 600 volts. One or two double-circuit, instantaneous interlocks can be supplied with Type B or added later at the job. A model with the same characteristics is also available for dc current.

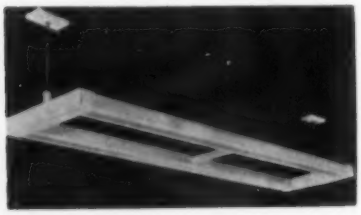
Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.



Fan-Heater **(25)**

The new "NW" series of heavy duty wall insert electric fan type heaters. Heavy duty single phase induction motor is located in the cold air intake and operates at room temperature. Each heater has conveniently grouped top located finger-lift switches for fan and heat, neon indicator light, thermostat for automatic control, and safety thermocutout. Thermostatic comfort control makes possible individual room or zone control of heat. All models have the same physical dimensions with a wall box size 18¾ in. high by 14¼ in. wide by 4 in. deep; operate on 240 volts, ac, 60 cycles. Available in 2000, 3000, 4000 and 4500 watts with or without thermostatic control.

Thermador Electrical Mfg. Co., 5119 District Blvd., Los Angeles 22, Calif.



Fluorescent Fixture **(26)**

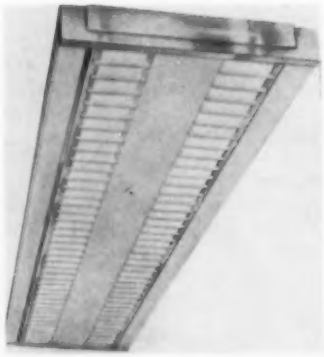
A new fluorescent lighting fixture, designated ILC, is designed specifically for high output rapid start lamps. Light distribution is semi-indirect and fixture accommodates two 48-, 72- or 96-in. lamps, with a maximum of 15,000 generated lumens in the latter size. Two variations of the ILC unit are available—one a plastic diffusing panel placed below each lamp and the other a plastic eggcrate louver. Luminaire provides a separate lampholder compartment. They are approximately 4⅞ in. in width and 3¼-in. in height. Compartments are on 19-in. centers and are formed from two parallel hollow roll formed steel sections. Compartments are open at top and plastic panel or louver fits in at bottom. Panels or louvers may be tilted out from below for relamping and cleaning. Provision is made for continuous row installation.

Silvray Lighting, Inc., RKO Bldg., Radio City, N. Y.

Lighting **(27)**

"Lyteline" transforms fluorescent lighting from utilitarian values to decorative illumination for any room in the home or for public areas. Lyteline is an elongated baffle (shield) behind which the fluorescent tube is set. The shield is executed in walnut veneer or in satin brass. Another version, finished in white enamel with grey center trim may be painted to match room colors. Wall unit directs soft light upwards to wash wall and ceiling surfaces, and downward for direct illumination by means of the special V-shaped baffle which gives a 40° shielding angle.

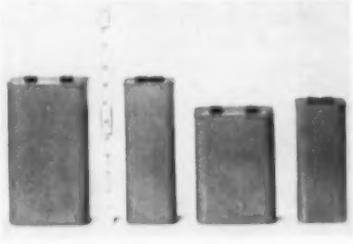
Lightolier, Inc., 346 Claremont Ave., Jersey City 5, N. J.



Fluorescent Unit **(28)**

The Twosome is a shallow fluorescent unit, 3½ in. deep, which provides 45° by 45° shielding. It is for two or four 4- or 8-ft rapid start bi-pin lamps and slimline lamps. The compound shielding is a center strip of extruded Polystyrene with white steel baffles on either side. Bottom shielding and side shields are one complete assembly, which hinges from either side, or may be entirely removed. Twosome may also be specified with plastic louvers, ribbed Skytex glass, or flanged polystyrene. Side diffusers are of extruded Polystyrene within a steel frame. May be installed surface or pendant, individually or in continuous rows.

Smithcraft Lighting, Chelsea 50, Mass.



Capacitors **(29)**

The rectangular base Pyranol capacitor line has been expanded to meet the growing needs of the air conditioning industry. Higher ratings are for single phase, central air conditioning equipment. Typical ratings for the new large base capacitors are 30, 35 and 50 microfarads at 440 volts. Base dimensions are 4⅝ in. by 2⅝ in, with heights up to 8 in. Ratings for small base are 20 microfarads, 440 volts and 30 and 35 microfarads, 370 volts. Base dimensions are 2⅛ in. by 2⅛-in., with heights up to 8 in.

General Electric Co., Ft. Edward, N. Y.

Important Wiring gets Permanent Protection with

SHERARDUCT

RIGID STEEL CONDUIT

Specify National Electric Sherarduct and you safeguard electrical wiring against corrosion for all time.

NE's Sherardizing process of dry galvanizing under heat actually alloys corrosion resistant zinc with the steel walls of the conduit. Threads are machined before galvanizing so that the entire length of the conduit receives a uniform protective zinc coating from end to end.

On the job Sherarduct helps cut construction costs. A slick inside coating of Shera-enamel makes fishing and wire pulling easy. The gradual heating and cooling of the Sherardizing process anneals the steel conduit . . . develops the ductility needed for efficient bending and working.

On the next conduit installation remember — Sherardizing is Galvanizing at its best—Sherarduct is Galvanized conduit at its best.

National Electric Products

PITTSBURGH, PA.

2 Plants • 11 Warehouses
35 Sales Offices

New Bell Telephone Building, Gateway Center, Pittsburgh, Pa., showing main vertical conduit runs of Sherarduct. Architects: Press C. & William C. Dowler. General Contractor: Mellon-Stuart Company. Electrical Contractor: Franklin Electric Company. Electrical Engineer: Carl J. Long.

NEVER A
DOUBT WHEN
THE PILOT
LIGHT'S OUT!
Don't guess next time your control line pilot light goes out. Make sure you're using Westinghouse Push-to-Test* indicating lights.
A gentle touch tests the light instantly because an auxiliary set of contacts energizes the bulb. When the light flashes on, you know there is
trouble somewhere else in the circuit.
Shock-resistant, U. S. Navy-type lenses with wide-angle visibility assure the best performance. They are available in crystal, red, blue, amber, green and opalescent—frosted to eliminate false indications.
Push-to-Test lights are only one of many outstanding units in the Westinghouse Oil-Tite* pushbutton line. For further information, ask for the new booklet (B-7022) or the Pushbutton Guide (B-6749), a 72-page catalog illustrating the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa., or call your local Westinghouse distributor.
*Trademark
J-30255
YOU CAN BE SURE... IF IT'S
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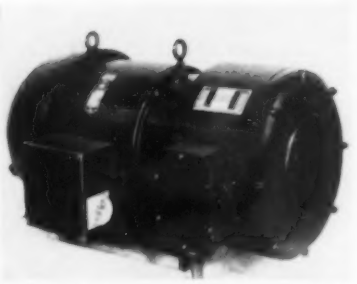
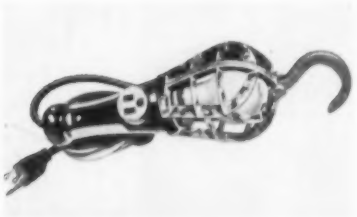


Converter **(30)**

A new "Nobrush" frequency converter delivers 400 cycles, 3-phase, 120/208-volt, 15 kva continuous, 22.5 kva for short period overloads. Totally enclosed fan cooled construction utilized. Use of light metals and "Nobrush" design holds weight within 500 lbs. for complete motor-generator combination. Overall dimensions 36 in. by 19 by 21 in. Motor operates at low speed of 1800 rpm from standard 220/440-volt, 3-phase, 60-cycle supply.

Georator Corp., Manassas, Va.



Service Light **(31)**

A new series of grounded, completely insulated portable service lights provides safety around hazardous locations. No. 5999 series features a canvas molded cage and a molded phenolic handle which has no exposed metal. No. 5999-RGH is equipped with 25 ft of red thermoplastic cord, a molded plug, reflector and a reinforced, fibre swivel hook. Molded into the handle is an approved, 3-wire convenience outlet which provides grounded power for tools.

McGill Manufacturing Co., Inc., Valparaiso, Ind.

Transformers **(32)**

A new line of power transformers, called "Preferred Design", incorporate electrical flexibility with mechanical features. They can be built in any rating from 5,000 to 50,000 kva. Line includes 3-phase OA, OA/FA, OA/FA/FA and FOA cooled units, with and without load tap changing, at voltages of 60, 115 and 138 kv. In addition to mechan-

ical features preferred by a majority of power transformer users, PD transformers will have an improved base design for easier handling, better grouping of cooling equipment and, on units above 12,000 kva, a new control cabinet to house controls and indicators.

General Electric Co., Power Transformer Department, Pittsfield, Mass.

Time Switches (33)

New tungsten-rated time switches, designated as Intermatic "T-Rated" switches, carry a momentary inrush surge of more than eight times their normal amperage rating. They are especially designed to handle heavy-duty incandescent lighting loads. "T-Rated" models are specially designed to counteract contact welding. Models include standard On-Off, switch, Skipper and short interval (5 to 60-minute) switches. Features are new alloy-T contacts, with increased contact surface and self-cleaning design; new spring brass U-beam blades; new Hi-power switching mechanism. Switches are approved by UL and CSA.

International Register Co., 2624 W. Washington Blvd., Chicago, Ill.

Cable Reel Brake (34)

A new safety cable reel brake assures a steady pay out of cable, wire or strand. It consists chiefly of a brake drum with band and adjusting bolt assembly, anchor for brake band, and a clamp for locking the cable reel to the spindle. Cable reel brake becomes an integral part of the cable reel trailer. Or, the brake can be transferred from one trailer to another by exchanging spindle complete with brake.

Utility Tool & Body Co., Clintonville, Wis.

DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

Mail coupon for FREE Dosson "F" Connector

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:
Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

Name_____

Address_____ Zone____ State_____

City_____

50 YEARS OF TECHNICAL KNOW-HOW

Excl. Canadian Distributor: W. S. Gerrie & Assoc., Ltd.
4158 Dundas St. West, Toronto 18, Ontario

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Certified Lighting for a Better America

NEW MAINLINER LUMINAIRES SAVING INSTALLATION COSTS 3 WAYS!

Westinghouse has now created a line of *completely new* and *radically improved-type* luminaires for interior lighting!

They are named the Mainliner Luminaires—incorporating *every desirable feature discovered* and *every important advancement made* in luminaire design and construction, *throughout the past 10 years!*

As a result, these Mainliner Luminaires produce *substantial* savings—of costly installation time and expense—in *three distinctly definite ways!*

Mainliner Luminaires are completely modular—coming in exactly 1-foot, 2-foot and 4-foot widths—and 2-foot, 4-foot and 8-foot lengths. This makes it easy to plan their application—enables workers to "figure" and "lay out" each job *right!* The *first* time! *Every* time!

Mainliner Luminaires are *dimensionally correct!* This makes them "mate" exactly with any type whatsoever of "squared" ceiling material—and *eliminates* the usual "wedging", "pinching" and misalignment that *frequently* require "over-all compensation" and time-consuming delays!

Then, each Mainliner Luminaire housing comes *complete—pre-assembled* and wired!—all ready for *immediate* installation! Doors and shields, too, are *pre-assembled*—for *quick* hanging! Saves up to 30% of installers' time!

In addition, Mainliner units are specially reinforced—making them rigid, easier to "handle", *much* faster to mount! Their extreme "shallowness" helps avoid plenum chamber difficulties. Combination knockouts are located everywhere required. And "wrap-around wireways" and "either-end" lead wires save *hours* of *electricians' time!*

Mainliner Luminaires will help *you, too,* to *beat installation estimates!* J-04419

Exceptional Variety and Advanced Design Simplify Application!

Helps to increase Contractors Modernization Sales!

Mainliner Luminaires—in 6 different sizes, 4 mounting types and 13 selected shieldings—permit a *tremendous* number of striking and appealing, new, modern ceiling designs!

This *already* is making Mainliner Luminaires, favorite, for example—in retail-store modernization. And *every* progressive retailer *knows* how vital good lighting is—*if his store is to compete!*

Some retailers emphasize the use of light to identify strongly, or to distinguish their stores. Some say, "The *cash value* of good lighting can *actually be measured* by the *increased store-traffic* that better lighting brings!"

Others insist on adequate lighting as . . . "The mainstay of display"! One more group considers that lighting should be . . . "Top on the list of *store fixtures, essential* in order to *secure repeat business*"!

This is the significant "sales information" for enterprising contractors. And contractor after contractor already has reported . . . "selling retail-store modernization is easier when I start by recommending Mainliner Luminaires"!

get the help of your near-by Westinghouse representative! Ask him to show you how you, too, can INCREASE MODERNIZATION SALES with Mainliner Luminaires!

YOU CAN BE SURE... IF IT'S Westinghouse

IT PAYS TO HAVE GOOD CONNECTIONS

HUBBELL

the first and only

GROUNDING Twist-Lock®

3-WIRE, 15 AMP. 125 VOLT

Here is the "Twist-Lock" equivalent of the 5262 Line of Straight Blade Grounding Devices.

CAT. NO. **4730**
Connector Body

UL

A COMPLETE NEW LINE . . .

NON-INTERCHANGEABLE

WITH REGULAR "TWIST-LOCK"

NOTE THE SPECIAL ELBOW-SHAPED GROUNDING SLOT.

These new 4700 Series Grounded "Twist-Lock" units are polarized to prevent interchange with regular 125-volt "Twist-Lock" devices. An elbow-shaped grounding slot prevents insertion of regular "Twist-Lock" caps, accepting 4700 Series caps only. With 4700 Series "Twist-Lock" units there is absolutely no danger of plugging into a 3-phase circuit by accident.

Write today, for complete information.

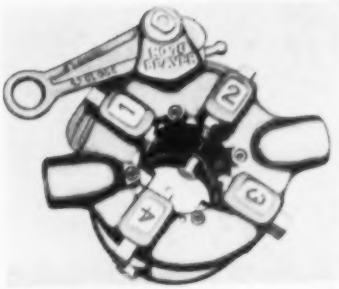
HARVEY HUBBELL, INC.

HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS

DEPT. D BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

Bridgeport 2, Connecticut
State and Bostwick Streets
Chicago 7, Illinois
37 South Sangamon Street
Los Angeles 12, California
103 North Santa Fe Avenue
San Francisco, California
1675 Hudson Avenue
Dallas 7, Texas
1111 Dragon Street



Threader (35)

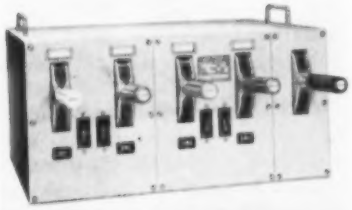
Threading dies 1¼-in. wide are a feature in the No. 78 quick-opening power drive threader. No. 78 threader threads all sizes 1-in. to 2-in. with one set of high speed steel dies. No. 78 is made specifically for power drive use. When thread is cut, dies are thrown open and tool is ready to use again without resetting. A new rear guide gives thread alignment.

Beaver Pipe Tools, Inc., Warren, Ohio

Scaffold (36)

A new portable hydraulic scaffold, called Jim Dandy Jr., weighs 860 lbs and is portable in a pickup truck. It has a lifting capacity of 800 lbs and elevates the 2½-ft by 8-ft working platform, fully loaded, to a height of 10 ft. Elevation and lowering of platform is done by a ½ hp electric motor controlled from the scaffold platform. Unit is mounted on casters for movability on the job.

Adam Company, P. O. Box 628, Perry, Okla.



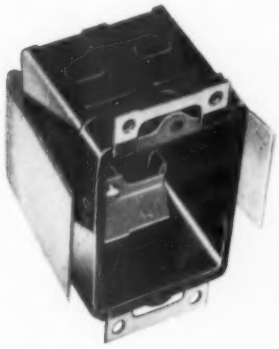
Light Control Equipment (37)

Packaged Luxtrol light controls in the new DC-2500 series provide complete light dimming, brightening and blending for schools, theatres, churches and other applications which require individual circuit control up to 2500 watts. Package can be used as a portable unit or stacked to build a large switchboard. Available in packages of three, four, five and six con-

trollers with individual controller ratings of 2500 watts. Also a new DC-1000 series is available.

A console type magnetic amplifier light control system. Available in 3000, 6000 and 15,000-watt capacities, all systems operate directly from any 120-volt, 60-cycle source.

Superior Electric Co., 83 Laurel St., Bristol, Conn.



Boxes **(38)**

No. 7020-8, 2¼ in. high by 2⅛ in. wide and 3¼ in. long snap-in box features convenient snap-in bracket; ears permanently fixed for alignment; ears raised above top surface of box; snap-in bracket replaces metal holding strips; fits ¼-in. to 1-in. wall thickness; stepped and wall design provides same convenient wiring features of angle bottom box; and has 11.8 cu. in. wiring capacity. Snap-in outlet boxes also available in 3¼-in. and 3½-in. round size.

Union Insulating Co., Parkersburg, W. Va.

Fluorescent Unit **(39)**

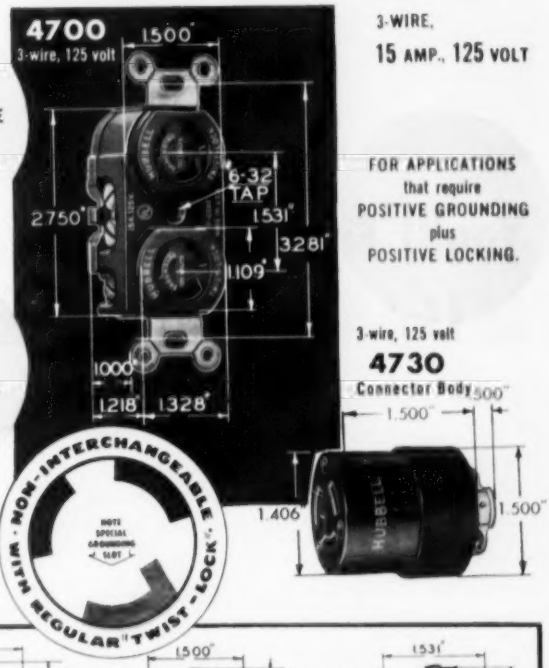
A plastic-enclosed fluorescent unit, for lighting corridors, pedestrian tunnels and other long, narrow traffic areas. The Freeway, for one rapid-start bi-pin lamp, has a one-piece extruded polystyrene shielding. Knockouts at ends of housing are provided for continuous wiring, end caps fasten together for continuous rows. Plastic shielding snaps in and out of place.

Smithcraft Lighting, Chelsea 50, Mass.

ANNOUNCING
A COMPLETE NEW LINE

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

Twist-Lock®
approved for GROUNDING purposes only!



A COMPLETE NEW LINE . . . NON-INTERCHANGEABLE with REGULAR "TWIST-LOCK" UNITS

3-WIRE, 15 AMP., 125 VOLT

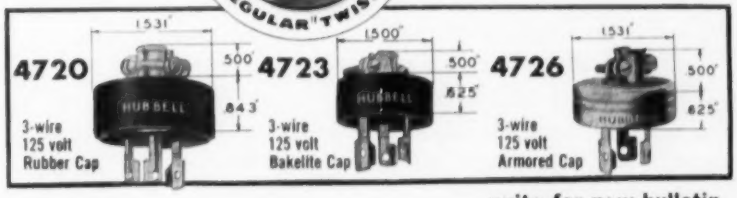
FOR APPLICATIONS that require POSITIVE GROUNDING plus POSITIVE LOCKING.

GREEN HEXAGONAL GROUNDING SCREW.

ALL UNITS IN DISTINCTIVE BROWN COLOR.

Elbow-shaped grounding slot prevents insertion of regular "Twist-Lock" caps. Accepts 4700 Series Caps only.

NOT INTERCHANGEABLE WITH REGULAR "TWIST-LOCK"



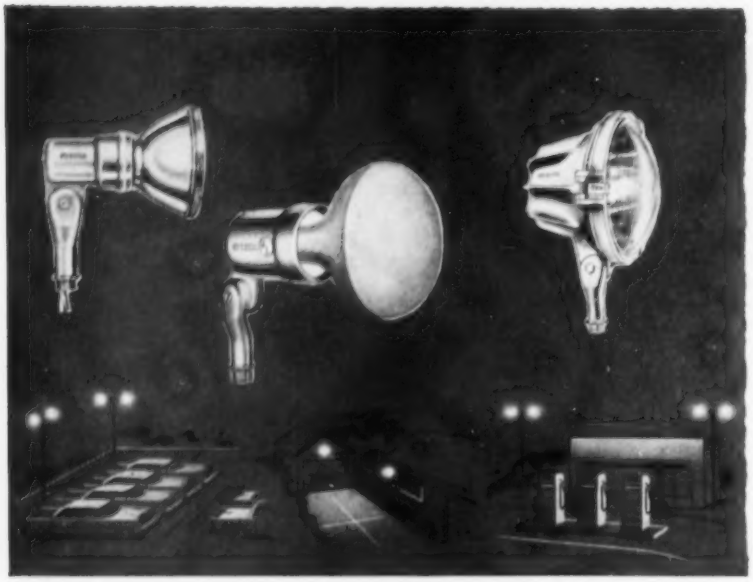
write for new bulletin.

FIRST . . . and still the FINEST!

HARVEY HUBBELL, INC.
BRIDGEPORT 2, CONNECTICUT

Sold only through authorized electrical distributors.

QUALITY WIRING DEVICES



You'll Find More True Economy in Lighting Units by STEBER

Lifetime cast aluminum Steberlites give you economy—economy in quicker, easier installation, lower maintenance costs and in overall lighting efficiency.

Steberlites will solve most every lighting problem easily and effectively. They mount quickly to poles, outlet boxes and walls and can be used as single units or in multi-lamp clusters. Weatherproof articulated joints allow universal aiming. Silicone lamp gaskets assure complete weather protection. A wide variety of Steber fittings lets you tailor-make lighting units to any special requirement.

Steberlites accept PAR-38 and R40 medium or mogul base spot and floodlamps. S-400 shown above uses the 300 watt, 80,000 candlepower PAR-56 lamp. Color lenses are available for special effects.

Write for Steberlite literature now. See why versatile Steber units can serve you best.

New Condensed Catalog CTC-1 available upon request.

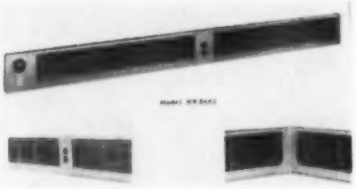
Lighting Units STEBER *for Every Need*

STEBER MANUFACTURING CO. • Dept. 98, Broadview, Illinois

STEBER MANUFACTURING CO. OF CALIFORNIA
242 So. Anderson St., Los Angeles 33, Calif.

STEBER-WOODHOUSE, LTD.
33 Ingram Drive, Toronto, Canada

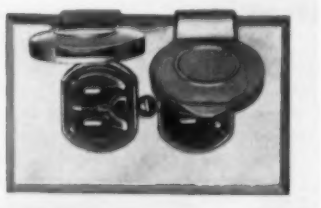
SOLD THROUGH LEADING DISTRIBUTORS



Baseboard Heater (40)

A new slim design baseboard glass radiant heater extends only 1¾ in., without being recessed. This baseboard system includes a new baseboard level thermostat which can control up to seven 650-watt heater sections, a duplex electrical outlet section, a 90° internal corner section and a wire raceway provided at bottom of unit. Ratings are 650 watts, 240 volts, 2218 Btu. Length of each heater section is 36¾ in. Unit can be painted to match decor. Approved by UL.

Berko Electric Mfg. Corp., 212-40 Jamaica Ave., Queens Village, N. Y.



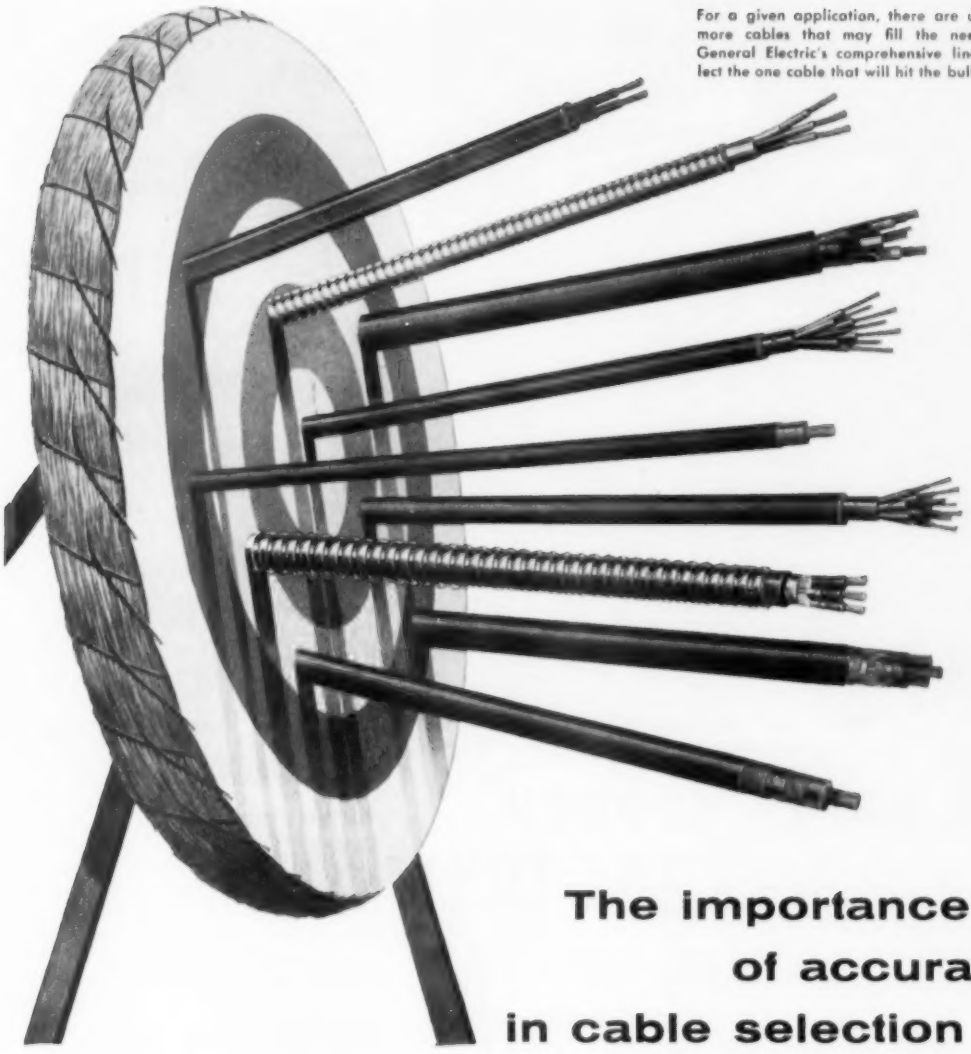
Receptacles (41)

Duplex receptacles with self-closing covers are now available in either single or double-cover styles. They are designed to withstand snow, ice or interior moisture conditions. Both models feature brass plates in an aluminum finish; cast metal covers; and stainless steel spring hinges. Receptacles may be had in 3-wire U-ground styles rated at 15 amps at 125 volts, or 15 amps at 250 volts; and also as parallel-slot duplex types.

Perfect-Line Mfg. Corp., Old Country Rd. & Railroad Ave., Hicksville, N. Y.

Fans (42)

A new line of Airfoil centrifugal fans for heavy duty industrial applications. They are available with single and double inlet construction in a large number of sizes for volumes up to 1,000,000 cfm. Wheel in the new fans is of welded construction with blades of airfoil cross section. Hub of cast steel is riveted to hubplate and bored to close tolerances for optimum fit on shaft. Housing is of all-welded



For a given application, there are usually one or more cables that may fill the need. And from General Electric's comprehensive line you can select the one cable that will hit the bull's-eye for you.

The importance of accuracy in cable selection

Today, selection of the best wires and cables for your customers' particular needs demands that a wide variety of factors be considered, ranging from standard requirements such as flame-resistance, heat-, moisture-, and weather-resistance — to special constructions which withstand vibration, the electromagnetic effects of adjacent power cables — even the effects of atomic radiation.

General Electric has developed hundreds of cables for just about every possible application. Thus, General Electric engineers are never limited to one wire or cable for a given job but can suggest the most efficient and economical solution for the particular situation.

This is one of the important reasons why many electrical contractors work with General Electric wire and cable engineers when they're planning important wiring jobs. Another reason is General Electric's knowledge of the requirements of other basic components of power distribution systems—transformers, load centers, switchgear, etc.—the knowledge that the right cable plays an important part in satisfactory system performance.

All this adds up to experience that can benefit you. Take advantage of it the next time you have a cable selection problem. For information on your specific wire and cable application or selection problem, see the G-E wire and cable specialist in your locality or write Section W207-718, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

Each of the two illustrated troughs can carry as much cable as all of the paralleling conduit.

COPE CABLE TROUGH SAVES STEEL BY THE TON!

Problem. 100 miles of cable to be supported in a New Jersey power generating station.

Solution. A careful cost analysis of available methods and materials convinced plant engineers that Cope's expanded-metal cable trough was the best choice. Why? Among other reasons, it meant a saving of more than a ton of steel for every 60 feet of trough installed, as compared to conduit . . . a total saving in excess of 250 tons of steel for the 15,000 ft. of trough required for the completed job!

Here's How You Save. *One* 10 foot section of 24" width Cope trough supports as many cables as 16 lengths of 4" conduit and it only weighs 54 lbs., compared to 575 lbs. for this same amount of conduit. This adds up to real economy regardless of the size of your installation. Cope's expanded-metal cable trough simply uses *less* steel to do the job and obviously this can mean substantial savings for you!

Cuts Labor and Maintenance Costs, Too. Design and construction features of lightweight Cope trough speed installation of space saving systems—even in the most cramped quarters. Easy-to-get-at trough simplifies cable inspection and repair . . . provides ready re-routing and facilitates system additions.

You save *three* ways when you specify Cope cable supporting equipment . . . trough, ladder or channel.

- **LOWER FIRST COST**
- **LOWER INSTALLATION COSTS**
- **LOWER SYSTEM MAINTENANCE COSTS**

Discuss these advantages for *your* installation with a qualified Cope representative—or write to T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

1069

T. J. COPE *Division*

ROME CABLE CORPORATION

steel construction braced with stiffeners. A split section housing design facilitates wheel removal for inspection or maintenance. Volume control for fans can be achieved with an adjustable speed fluid drive, inlet vanes, outlet damper or adjustable speed ac motor.

American-Standard Product (Canada) Ltd., Canadian Sirocco Products, 310 Ellis St. East, Windsor, Ont.

Switchboard Equipment (43)

Metal-enclosed outdoor switchboard equipment eliminates need to allot control building space for switchboards, and permits units to be located near apparatus they help protect, thereby reducing the amount of wiring needed. Space is provided at front of enclosure for protection and convenience of servicing personnel, allowing maintenance to be carried on during inclement weather. Enclosures are equipped with internal illumination, heaters, outlets and ventilation.

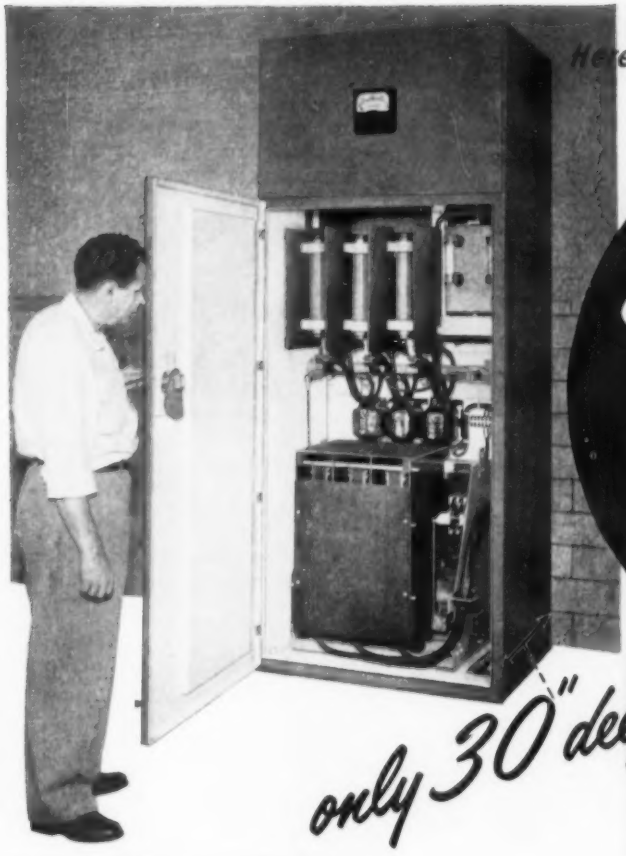
General Electric Co., Medium Voltage Switchgear Dept., Philadelphia, Pa.

Winder (44)

A new fish tape winder, known as "Jr. Tape-Mate", fits all small, approximately 8-in. diameter, round fish tape reels containing ¼ in. flat fish tape. Finger-grip design helps to prevent hand from slipping as operator pulls to pay out fish tape, pushes to wind it up. "Tape-Mate maintains uniform tension on fish tape while winding. It has a completely enclosed slot that guides the fish tape as it comes off the reel.

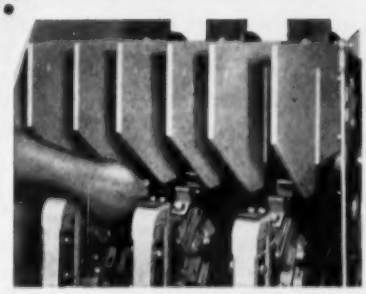
Holub Industries, Inc., P. O. Box 903, Sycamore, Ill.

Here is **DESIGN LEADERSHIP** *...in Action!*



Save Space with New EC&M High Voltage (2200-4800 VOLTS) Starters

only 30" deep!



NO DRAW-OUT NEEDED • Arc shields slide out horizontally, making front and rear contact-tips removable with standard wrench.

Accessible from Front...

(Solid back) • Starters may be mounted against wall or in double row, back to back

Safe...

Starter DISCONNECTED from bus as door is opened
Low voltage section isolated from high voltage

Interlocked...

against accidental closure by simple rod mechanism
Large wiring space for incoming leads

EC&M's new ZHA Starter not only saves valuable floor space—it provides more accessibility and convenience than ever before. Starters are available with self-contained bus in isolated compartment. A gang of starters requires only one incoming feeder. Additional starters can be added as needed—with no sacrifice in neat, streamlined appearance. All starters are self-contained and complete with control transformer supplying low voltage for pushbutton circuits.

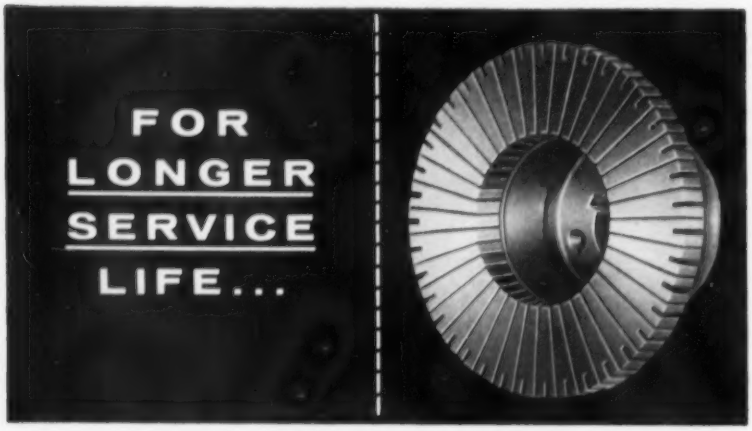
Write for **BULLETIN 8130-F**

3 Interrupting Ratings for Squirrel Cage, Synchronous and Wound-rotor Motors

1. **CLASS E 1** • 50,000 KVA (symmetrical) based on certified tests.
2. **CLASS E 2** • With current limiting fuses and high interrupting capacity contactor. At 2300 volts: 150,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical. At 4,800 volts: 250,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical.
3. **VALIMITOR®** • May be used on a bus of unlimited short circuit capacity, through the use of a contactor with an interrupting rating of 50,000 KVA, and reactors which limit any fault current to a maximum of 25,000 KVA.

THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

7955



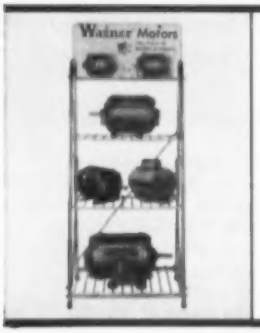
always replace with genuine
WAGNER COMMUTATORS

GENUINE JOE SAYS:

Wagner Replacement Commutators will last for years and years. That's because they're built with care to provide the extra strength needed for longer life. They're high-speed tested to withstand great centrifugal force. And they're safe to reface, too.

You get these 5 important features.

1. Mica washer insulates commutator from the short-circuiting ring.
2. Short-circuiting ring is made of brass.
3. Bakelite washer insulates short circuiting ring from commutator hub to eliminate harmful shaft currents.
4. Reinforcing steel shell.
5. Entire assembly is molded in high impact phenolic compound.



BOOST YOUR MOTOR REPLACEMENT SALES WITH THIS MERCHANDISER

Sell Wagner Motors to replacement-minded customers with the "sale at first sight" aid of the Wagner Merchandiser . . . colorful, chrome-plated display stand. Just $9.95 with your order for any 10 Wagner Motors in one lot. Check into this deal today.

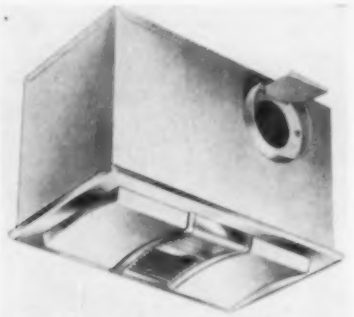
Wagner Electric Corporation
STAYING INDUSTRY SINCE 1891

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U. S. A.

MOTORS • BEARINGS • STANDARD ROTORS
BRUSHES • CAPACITORS • COMMUTATORS

OVER 950 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

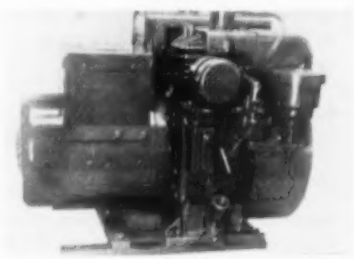
MS87-4



Fan and Light Fixtures (45)

A combination fixture which provides both ventilation and illumination for bathrooms or small kitchens. Ventilation is provided by a 6-in. pressure blower blade and heavy duty moisture-resistant motor and is designed to operate quietly. Two concave glass diffuser lenses insure even, glare-free light from the unit's two 60-watt bulbs. Unit features pressure wire springs which allow entire frame to snap out and hang free for cleaning and bulb changing. Fixture fits between joists and can be used for either vertical or horizontal exhaust with a 4-in. round duct. Fan and light can be connected to separate switches for individual operation.

Berns Air King Corp., 3050 *North Rockwell St., Chicago* 18, *Ill.*



Electric Plant (46)

A new self-contained electric plant of small size. Especially suited for portable service, the plant develops a full 1500 watts, 110-volt, ac in a "packaged" unit taking less than 2 sq ft of space. Powered by a heavy-duty, one cylinder, air-cooled engine, Model 31-B has an oversize generator. It has two convenient "twist-tight" outlet receptacles for connecting lights, appliances or tools. All electrical equipment is completely enclosed. A special 12-volt winding on generator acts as a starter and also provides 300 watts at 12 v dc for battery charging purposes.

Universal Motor Co., 438 *Universal Drive, Oshkosh, Wis.*

It's really no trick to bend

NATIONAL ELECTRIC XDUCT JUNIOR, E.M.T.

NE XDUCT JR. IS a high quality, very ductile metallic tubing that is easy to bend. When properly bent, Xduct Jr. will not flatten at the bend.

IN ADDITION, NE XDUCT JR. HAS . . .

- A silver-bright, electrogalvanized protective zinc coating that will not flake or crack.
- An inner wall finish of a special, new, easy-fishing NE Aluminum Enamel.

It's BETTER on the inside . . . BETTER on the outside

Listed by Underwriters' Laboratories, Inc.

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices

New BLACKHAWK ALUMINUM "1-bite" benders slash bending costs 77%

Now your own men can easily make factory-like bends while you enjoy BIG SAVINGS!

Super-portable Blackhawk electric-powered hydraulic pipe benders *save up to* 77% compared to cost of manufactured ells! Pay for themselves in just 35 bends.

BLACKHAWK offers benders in ALL price and size ranges to meet every bending need!

NINE complete Blackhawk bending sets handle 1¼" - 2" diameters thin-wall conduit — ½" - 4" diameters rigid conduit and pipe. Your choice of either lightweight rugged steel or new, featherweight aluminum construction.

MODEL	PUMP	DIAMETERS
S-30A	Hyd. hand pump	1, 1¼, 1½, and 2" rigid conduit and pipe
S-34	Hyd. hand pump	1¼, 1½, 2" thin-wall conduit
S-36	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe
New S-130 1-bite	Hyd. hand pump	½ - 2" rigid conduit and pipe
New S-132 1-bite	Electric-powered pump	½ - 2" rigid conduit and pipe
New S-137 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe
New S-138 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-139 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-140 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe

call your electrical or industrial supply house now!

BLACKHAWK®

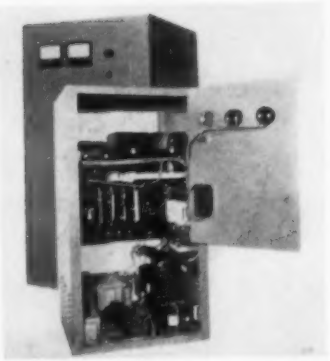
BLACKHAWK MFG. CO., Dept P-2077, Milwaukee 46, Wisconsin

Hydraulic pipe benders

Hydraulic Knock-Out punches

Hydraulic jacks 1½ to 100-tons

BLACKHAWK bends prove BLACKHAWK'S best!



Battery Charger (47)

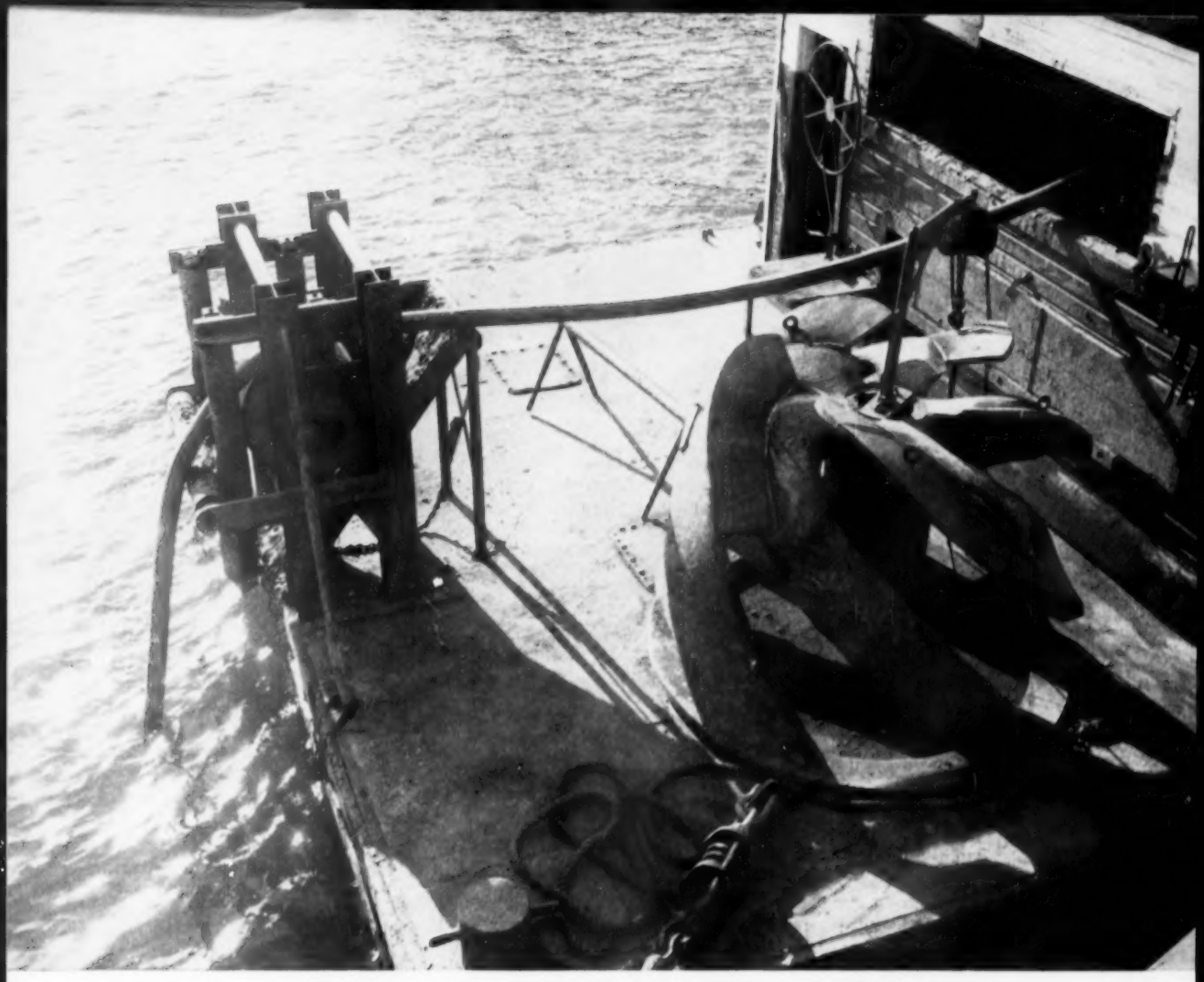
A new 60-cell, automatic battery charger for use at unattended substations and other locations when stand-by batteries have to be ready for immediate use. The selenium rectifiers have inorganic, non-oxidizing barrier layers which are corrosion and moisture proof and are capable of continuous full load operation in 50°C. ambient temperature without deterioration. The high gain magnetic amplifier control circuit automatically regulates output voltage to plus or minus 1%. The rectifier power circuit is full wave. Unit is available in 3-, 6-, 12-, 30- and 60-amp models.

The Walker Div., Norma-Hoffmann Bearings Corp., Stamford, Conn.

Intercommunication System (48)

A high-powered intercommunication system with transistors and printed circuits now is available for use in offices, plants, schools and other institutions, and homes. Transistors in place of tubes will be optional on all units. The new Teletalk sets can be added to, or used as replacements, in existing Teletalk intercommunication systems without adaptations and combined to provide any type of system desired. New developments are combination light and buzzer annunciators; special miniature relays to implement the operation of the annunciators; feather-touch talk-listen control switches, "no-snoop" silencers, separate pilot and busy-signal lights and special sound controls to regulate incoming volume. All have plug-in type junction boxes. Capacitors on single bank models in both the custom and executive series range from six to 24 stations without annunciators and from six to 12 with annunciators.

Webster Electric Company, Racine, Wis.



Built for a long life of hard knocks, this 4,500-foot, 3-phase, 20kv, shielded Okolite insulated cable with Okoprene sheath powers the rotary cutter head at right. Although nearly 5 inches thick, this cable has all the flexibility needed for dredging operations.

the previous OKONITE cable lasted 15 years ...but this one is built for even better service

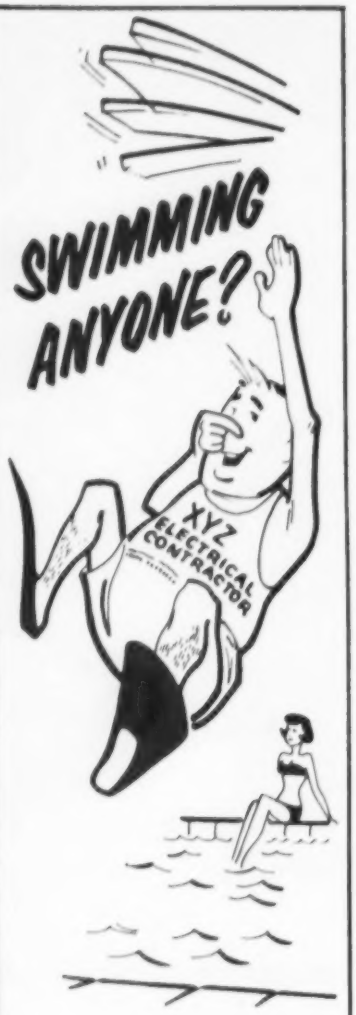
Pacific Dredging Company has recently put into service an Okonite replacement for an Okonite 15kv armored cable that had seen fifteen years of successful service . . . two to three times normal expectancy. In the strenuous operation of cables feeding power to giant dredges from shore stations, five years' service life is considered good.

But the new cable was designed to last even longer than its predecessor. The major cause of breakdown in dredging cables has been deterioration of the armor wire, which breaks and punctures the insulation. To overcome this, Okonite engineers replaced the armor with a tough, mold-cured, reinforced Okoprene sheath. Although this construction has only been in operation for a year, Pacific Dredging Company is confident that it will outperform the old one.

This example of Okonite's constant determination to "better the best" shows why Okonite has always been considered a leader in developing and building the finest cables available. Do you have a cable problem? There's a good chance that Okonite engineers have already solved it. Find out today. The Okonite Co., Passaic, N.J.

4349

where there's electrical power . . . there's **OKONITE CABLE**

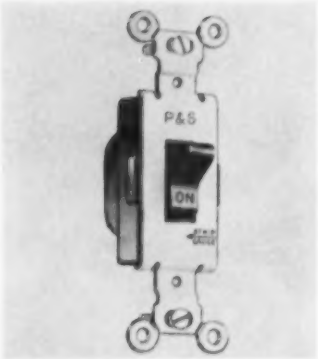


GAIN MORE FREE TIME WITH THE NEW G-E

EASY-TO-WIRE METER SOCKET

It's fast to wire and easy too—installing the new, improved General Electric S-1 square meter socket is a snap. Comes with lay-in terminals and plenty of knockouts—an electrician's delight. And versatile! Your choice of one, two or no hubs. Priced right too! Get details from your G-E Distributor or WRITE FOR FREE BULLETIN GEA-6563, G.E. Co., Schenectady 5, N.Y. Sec. 625-7.

GENERAL ELECTRIC



Switch (49)

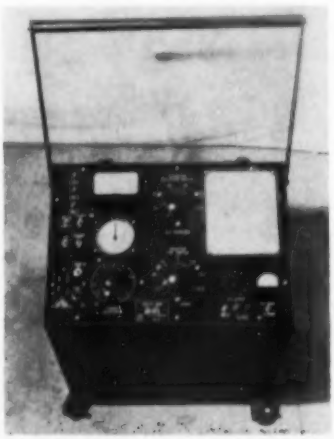
A new 1501 series of toggle-type electrical switches for residential use, including six models featuring pressure-type screwless terminals. No. 10 or 12 wire can be used. Protective bosses keep wires in position when the device and conductors are pushed into outlet box during installation. Switches are rated at 10 amps, 125 volts and 5 amps, 250 volts. They are available in brown or ivory single pole, 3-way with line shunt and single pole with line shunt. All are listed by UL.

Pass & Seymour, Inc., Syracuse, N. Y.

Lighting Bracket (50)

A new 10-ft aluminum tapered elliptical lighting bracket designed for existing or new utility poles. It withstands 100 mile-per-hour wind loadings. Mounting plate is small in area, requiring one thru-bolt and two lag screws to install.

Pfaff & Kendall, Newark, N. J.



Instrument (51)

Unit is applicable in any large industrial plant for testing overcurrent relays, motor overload relays, voltage relays, complete switchgear timing, throw over schemes, etc. Output current is adjustable in size ranges from 100 amps at 10 volts to 2 amps at 500 volts. Unit has a built-in ammeter, cycle counter, reactor to provide sinusoidal wave form, Vernier control, and a dc supply for testing relay targets and seal-in units. It is housed in a metal enclosure mounted on four wheels.

Multi-Amp Corp., 465 Lehigh Ave., Union, N. J.

Platform Lift (52)

New safety features have been added to the 35-ft telescopic platform lift, called "Sky-Ride". Features are—safety control valve at hydraulic fluid return outlet; built-in leveling plumb for ease in leveling platform with outriggers, and all riveted and welded construction. Unit can be stopped and locked in any position from 9 to 35 ft. Deadman type controls in base and on platform. It rolls from job to job on four 10-in Texite wheels.

Grand Specialties Co., 3101 W. Grand Ave., Chicago 22, Ill.

Lighting Fixtures (53)

A new series of 3½-in. deep fluorescent lighting fixtures featuring a one-piece wrap-around plastic shielding and one piece welded body. Designated as "Wrap-Around Plastoliers", this new series is designed for surface or pendant mounting. The shielding is made of extruded Ever-White polystyrene, and is removable for maintenance. Units are made in 4-ft length, two and four lamp rapid start, for individual installation or continuous runs.

Metalcraft Products Company, Inc., Philadelphia, Pa.

Ventilator (54)

A new all-aluminum propeller ventilator has been added to this line of centrifugal roof and wall exhausters. New Type FD roof ventilator features an aluminum propeller and spun aluminum construction of all other parts except the motor. FD is a direct drive ventilator with a pressure type propeller. It is made in four sizes from 680 to 4,040 cfm. Two-speed and explosion-proof design are available. Power assembly rests on rubber vibration isolators.

Loren Cook Co., 227 Depot St., Berea, Ohio

GET ALL THE SURPRISING FACTS ABOUT ALCOA ALUMINUM ELECTRICAL RIGID CONDUIT

Material price comparisons, plus the increasing cost of installation, have focused attention on the many advantages of Alcoa® Aluminum Electrical Rigid Conduit and the potential savings it provides. Such as:

—No maintenance painting; no staining

—Weighs two-thirds less than steel

—Easier to cut, bend, thread, install

—Nonsparking

—Up to 20% less voltage drop

They all boil down to new lows in the combined cost of materials and installation on inherently corrosion-resistant conduit installations. In the larger sizes, four inch for example, aluminum installed costs less than steel. In smaller sizes, rustproof, always-good-looking aluminum conduit costs only slightly more.

You can get all of these facts from your nearby Alcoa sales office or by writing for a copy of our rigid conduit booklet. We'd also like you to have a one-foot sample of aluminum conduit for inspection and testing. Just complete and mail this coupon.

ALCOA ALUMINUM CONDUIT
ALUMINUM COMPANY OF AMERICA

Underwriters' Laboratories, Inc. INSPECTED
RIGID CONDUIT
ISSUE MC-36

Your Guide to the Best in Aluminum Value

THE ALCOA HOUR—Television's Finest Live Drama, Alternate Sunday Evenings

Aluminum Company of America
2327-G Alcoa Building
Pittsburgh 19, Pa.

Please send literature on *Alcoa Aluminum Electrical Rigid Conduit* and a one-foot sample.

Name _____

Title _____

Company _____

Address _____

City and State _____

"Enough Give in RAWLPLUG MASONRY ANCHORS TO ABSORB VIBRATION of HEAVY DOORS" . . .

says RAWLPLUG USER FOR OVER 20 YEARS

Modern Doors Inc., Maplewood, N. J., manufacture overhead doors. They have served New York and New Jersey for over 30 years. Their heavy industrial doors are custom made and hung by their own installers.

From 4 to 12 Rawlplugs are used per door—only one size is used—⅜" x 2" for ⅜" lag bolt.

"NEVER HAD ONE 'LET GO'. . . ." says Dan Rice, Foreman.

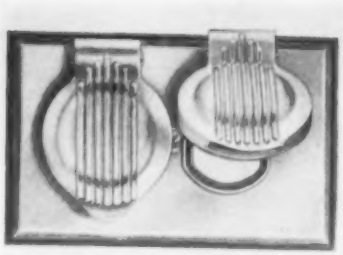
"There is considerable vibration and movement in raising and lowering these doors. There is enough 'give' in Rawlplugs to absorb this vibration. If shields are used, they will let go after a period of time. I've been using Rawlplugs for over 20 years and never had one 'let go'.

We give a one year guarantee against defective workmanship on all of our doors. I never have had to go back to replace a Rawlplug."

Installer uses power tool with Rawl drill to drill through wooden beam and into brick. Wooden beams are used to support springs which counterbalance Modern overhead door.

After hole is drilled, installer places Rawlplug into hole. Note that the lag bolt is partially inserted into Rawlplug. This permits the Rawlplug to be pushed through the hole in beam and into the hole in brick.

Using an electric powered wrench, the lag bolt is secured. Eight Rawlplugs were used to anchor 4 beams for spring supports for this size door (2 Rawlplugs per beam) and 4 Rawlplugs were used on surrounding framework for each door.



Receptacles (55)

Four new additions to the "Flip-Tite" line of outdoor weatherproof devices. No. 412 Universal plate, with "Flip" covers, will fit any standard duplex receptacle; can be used on new work, to replace old plates, or added to open outlets. No. 415 Universal is similar, but for single receptacles and switches. Two new weatherproof grounding duplex receptacles are 3-wire units, with U-shaped ground. No. 413, with parallel slots is 15-amp, 125-volt; No. 414, with tandem slots, is 15-amp, 250 volts. Both are UL and CSA listed.

Royal Electric Corp., Pawtucket, R. I.

Relay (56)

Type TS motor protecting relay is a precision instrument designed to protect a 3-phase, induction motor against shaft overloading, voltage unbalance and single-phasing. The instrument is connected in series with the holding coil circuit of the motor starter. On the relays for the small capacity motors, the current transformers are installed within the relay cabinet. In relays for motors of 200 hp and larger the CT-s are installed in the motor circuit.

Electrical Service Co., P. O. Box 1039, Greenville, Texas.

Wall Bracket (57)

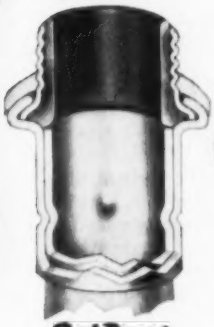
A new wall bracket No. 208P is for use in hospitals, hotels, kitchens, bathrooms, corridors, etc. Diffuser is formed of high transmission Plexiglas. Housing is of die-formed steel electrically welded. Fixture contains a wiring channel-reflector removable without use of tools. It has blind knockouts on end plates for pull switch and convenience outlets. All metal components are processed for inhibition of rust and discoloration with Pre-Fos process and finished in Neo-Lux baked white synthetic enamel.

Neo-Ray Products Inc., 315 East 22d St., New York 10, N. Y.

B-M

the original concrete-tight **INDENTER FITTINGS** *for E.M.T.*

Red Throat
Insulated
Connector



Red Throat
Cross section

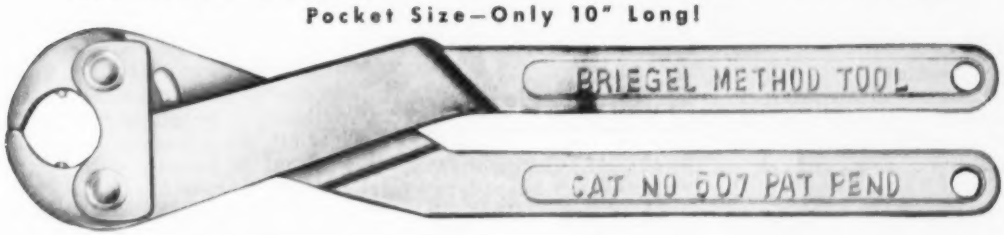
"BM" #100
Cutter for ½, ¾
and 1" E.M.T.

"BM" #1000
Holder for ½, ¾
and 1" E.M.T.

"BM" #600
Changeable Jaw Indenter

THE NEW BM607 INDENTER FOR ½" FITTINGS

Pocket Size—Only 10" Long!



Briegel Representatives from Coast to Coast

J. H. Akerman
813 Sistina Avenue
Coral Gables 46, Florida
Phone: Mahawk 7-3864

Harry C. Andrews Co.
5440 Gravois Avenue
St. Louis 16, Missouri
Phone: Hudson 1-7373

Crescent Electric Sales Co.
1800 N. Humboldt Blvd.
Chicago 47, Illinois
Phone: Albany 2-2600

R. L. Cunningham Electric Co.
843 South Front Street
Philadelphia 47, Pennsylvania
Phone: Lombard 3-3660 & 3-3109

L. J. Crews
1725 Arlington Road
Richmond 20, Virginia
Phone: 4-2273

Curtis Sales Corporation
3231 Warrenville Center Rd.
Shaker Heights 22, Ohio
Phone: Skyline 2-0225

Herbert L. Jones
745 Ohio River Blvd.
Pittsburgh 2, Pennsylvania
Phone: Linden 1-6684

Al Levin & Associates, Inc.
1200 So. Peters Street
New Orleans, Louisiana
Phone: Tulane 8480 & 8489

H. A. Maggiore & Son
15 Carleton Street
Cambridge 42, Mass.
Phone: Kirkland 7-4954

Ernst F. Hauch Co.
1282 Folsom Street
San Francisco 3, California
Phone: Hemlock 1-1828

R. C. Handy Sales Co.
4811 Excelsior Blvd.
Minneapolis, Minnesota
Phone: WAlnut 6-2939

L. D. Hood Sales
1133 West 8th Avenue
Denver, Colorado
Phone: Acoma 2-8001

A. Lee Clifford
1801 West 18th
Indianapolis 7, Indiana
Phone: Melrose 6-4449

Walter S. Nash
2101 Tula Street, N.W.
Atlanta, Georgia
Phone: Elgin 8071

Rutkin Electrical Sales Co.
935 Stanford Avenue
Los Angeles 21, California
Phone: Tucker 1224 & 5

Valkus-Kissel
1711 Kelly Street
Dallas 1, Texas
Phone: Hamilton 8-7388

W. W. Wheat & Son
2219 4th Avenue
Seattle 1, Washington
Phone: Seneca 6222

Arnold J. Young Co.
12600 Hamilton Avenue
Highland Park 3, Michigan
Phone: Townsend 9-5080 & 1

E. J. Martin Company
150 Nassau Street
New York 38, New York
Phone: Worth 4-6270

All B-M Indenter Fittings are U.L. Approved as concrete-tight and all Compression Fittings as rain-tight as well as for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

TELESCOPE BM SYSTEM

BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

Floodilght **(58)**

New No. 400P floodlight specifically designed for use with the 400-watt mercury vapor lamps, will accommodate up to a 500-watt incandescent lamp. Constructed of a cast aluminum head and featuring the NEPO patented aluminum Alzak reflector sealed over a heat resistant and impact resistant glass bowl. All fasteners and other fittings are of stainless steel and non-ferrous materials. Unit is dustproof and weatherproof. Available with an assortment of mounting brackets and fittings for all types of installations.

Nepo Manufacturing Co., 4230 North Sayre Ave., Chicago 34, Ill.

Switch **(59)**

Known as Quiette tap action switch, it provides instantaneous light control at the pressure of finger tip, hand, or elbow on any area of the button. Designed to fit any standard toggle wall plate. Available with conventional binding screws or screwless terminals, the switch has large silver alloy contacts. It is available for all standard connections in brown and ivory. With ratings of 15 or 20 amps, it operates on full voltage, non-relay and is rated as standard by UL.

Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.

Fluorescent Fixtures **(60)**

A series of surface mounting and a series for recessed mounting have been added to this line of Baylites, square fluorescent fixtures. The recessed Baylite is especially designed for the areas having shallow plenums to save space and add floor areas. It is 3½ in. The Surface Baylite allows an almost troffer appearance since it also is 3½ in. shallow. Both surface and recess units are squares—nominal 2-ft by 2-ft and 4-ft by 4-ft for modular layouts. They are available with either Plexiglas diffuser, or ½ in. cube shielding styrene louver. Ballasts are mounted against the sides of the fixture housing for maximum heat dissipation. The 2-ft by 2-ft recessed and surface Baylite is available with four or six lamps—the 4-ft by 4-ft is available with either four, six or eight lamps.

Electro Silv-A-King Corp., 1535 S. Paulina St., Chicago 8, Ill.

Switches **(61)**

Designed to operate in any position, the "No-Klik" line of mechanical quiet switches is approved for control of both incandescent and fluorescent lamp loads. Rated at either 15 amp, 120/277-volt ac, or 20 amp, 120/277-volt ac, these switches control fluorescent lamps on ac circuits of 277 volts or less at full rated switch capacity and motor loads up to 277 volts at 80% of current rating of switch. Switching mechanism is totally enclosed in a bakelite housing. Large head No. 8 binding screws will accommodate any wire size up to No. 10. Mounting strap has wide plaster ears. Available in single pole, double pole, and 3-way models with either brown or ivory toggle handle.

Circle F Mfg. Co., Trenton 4, N. J.

Product Briefs

(62) An aluminum alloy **guy protector** has been developed by Hubbard and Company, Pittsburgh, Pa.

(63) Ideal - Simplet Fittings, Inc., Sycamore, Ill., has developed a new malleable iron **pulling elbow**, which provides an easier means of pulling wiring around corners. . . . (64) The Standard Transformer Co., Warren, Ohio, has introduced its completely redesigned line of outdoor current and potential **transformers**, in voltages through 72,000. . . . (65) A light-weight **lever puller**, a compact hand tool for lifting, lowering and dragging in industrial, construction and farm fields, has been developed by the Harrington Co., Plymouth Meeting, Pa.

(66) Jer Mart Industries, Oklahoma City, has developed a **mechanical hand** for changing fluorescent lamps. It will handle all sizes and types of fluorescent lamps and starters in servicing lighting fixtures. . . . (67) Beaver Pipe Tools, Inc., Warren, Ohio, has announced that the new "Black Magic" honed **edge cutter wheel** is now the standard cutter wheel on the No. 2 pipe cutter, Model-A pipe machine and the Speed-O-Matic pipe machine.

(68) Delta-Star Electric Div., H. K. Porter Co., Philadelphia, Pa., has started the manufacture of oil filled distribution **transformers** from 5 kva to 167 kva in voltages up to 15 kv. . . . (69) A new **rod puller** recently placed on the market by T. J. Cope, Inc., Collegeville, Pa., is especially made to facilitate rodding of long conduit lines where the weight of the rod becomes a controlling factor.

(70) A new precision-made device, called the **programmer counter,** used to turn on and off test apparatus whose limits are sensed by strain gages, thermocouples or any other transducers that have a maximum output not exceeding 100 millivolts dc has been developed by Spar Engineering & Development, Inc., Wyncote, Pa. . . . (71) James G. Biddle Co., Philadelphia, Pa., has introduced Model 2 **corona test set** for nondestructive evaluation of electrical insulation in transformers, cables, capacitors and other electrical components.

(72) Rawlplug Co., New Rochelle, N. Y., has developed a new heavy duty **bolt anchor,** the Multi-Calk, for anchoring heavy equipment to masonry with bolts. . . . (73) A new heavy duty **electric hammer,** weighing 7½ lbs, is now being manufactured by Modern Manufacturing Co., Philadelphia, Pa. . . . (74) Beaver Pipe Tools, Inc., Warren, Ohio, has announced a new fibreglass reinforced abrasive **cutter wheel** for use on No. 14 and No. 20 speed-cut abrasive cut-off machines.

(75) Farrelloy Company, Philadelphia, Pa., has improved its Farco all **metal solder** to resist corrosion. . . . (76) The Wakefield Company, Vermilion, Ohio, has announced a new **shallow troffer,** in four sizes, with a wide range of diffusers including lenses, louvers and patterned vinyl.

(77) Wright Hoist Div., American Chain & Cable Co., Inc., York, Pa., has introduced a new lightweight electric **chain hoist.** . . . (78) A new type of high resistance **Megohmmer,** reading both in resistance and conductance, has been announced by Herman H. Sticht Co., Inc., New York, N. Y.

NEW, SELF-FUSING, WEATHER-RESISTANT SPLICING TAPE

FOR RUBBER AND PLASTIC CABLES

OKOWELD—an entirely new tape designed for use on rubber or plastic insulated cables . . . provides *one-tape* splices and terminations for service up to 2000 volts . . . mechanically tough . . . resistant to weather and moisture . . . flame-resistant . . . easy to apply . . . available in five colors for color-coding of splices . . . made from a new, self-fusing compound developed by the Okonite Research Laboratories.

TYPICAL USES—For *one-tape* terminating and splicing of service drop cables . . . portable cords and cables . . . power and lighting circuits . . . control cables . . . bus bars . . . communication cables.

SPLICED-FOR-LIFE FEATURES

Self-fusing	forms solid moisture sealing wall
Abrasion-resistant	approved by Underwriters' Laboratories
Compression-resistant	approved by Underwriters' Laboratories
Flame-resistant	passes Bureau of Mines Flame-Resistance Test
Splice aging	properties improve with age
Shelf life	one year guarantee

ONE TAPE—MANY USES—Compatible with all cable insulations and sheaths . . . polyethylene . . . PVC . . . natural rubber . . . GRS . . . butyl . . . neoprene. Use for:

Insulation and sheath	up to 2000 volts
Sheath over insulation	over 2000 volts
Color coding	available in Red, Blue, Green, Yellow and Black

STABLE IN SERVICE—Tested for more than two years in the laboratory, Okoweld shows excellent resistance to weather . . . ozone . . . chemicals . . . oils . . . hydrocarbons . . . moisture . . . mechanical damage.

EASY TO APPLY

Temperature range	handles well in hot or cold weather
Conformability	molds to irregular shapes
Cohesiveness	all surfaces bond permanently

U L APPROVED—Only self-fusing tape approved by Underwriters' Laboratories as "... the sole insulation and covering of joints and splices in electrical conductors."

Sold exclusively through Okonite's Authorized Tape Distributors

OKONITE splicing tapes

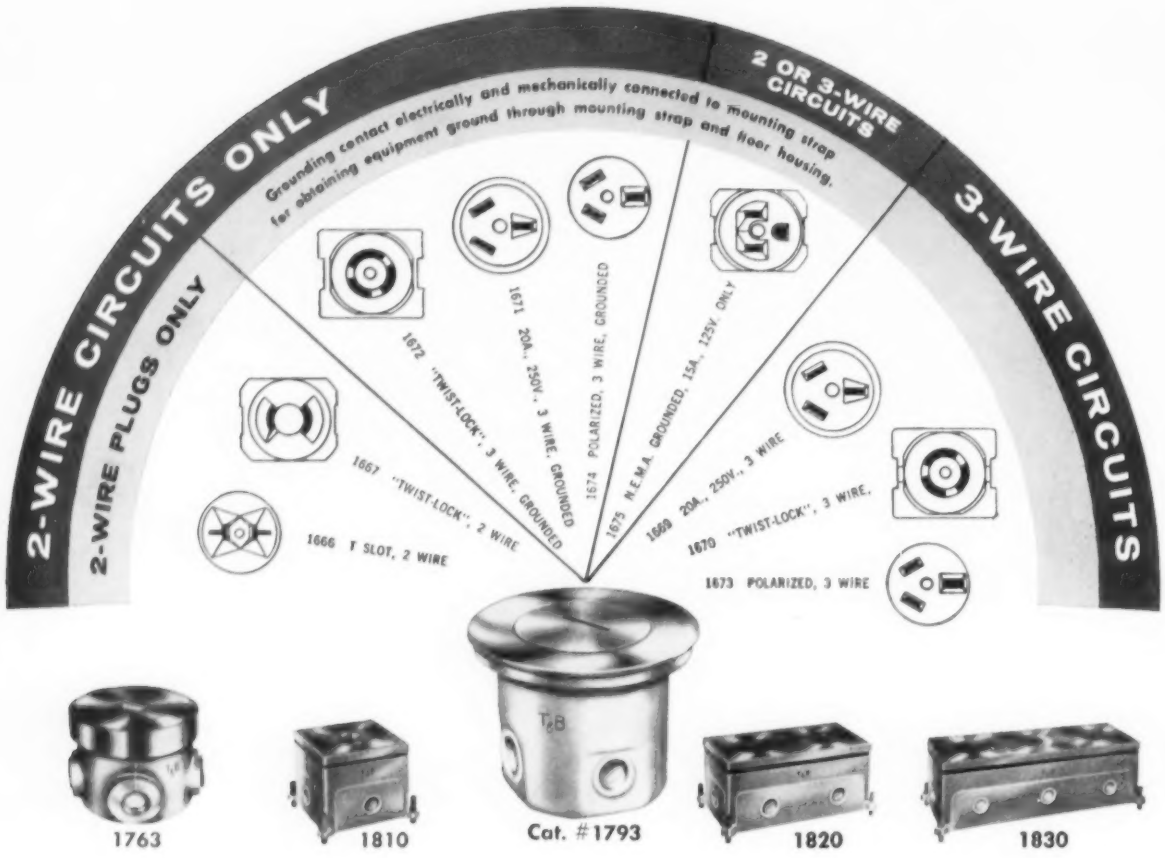
FREE SAMPLE ROLL

It's yours if you'll just fill out this coupon and mail it to: The Okonite Company, Tape Dept., Passaic, New Jersey.

Name_____ Position_____

Company_____

Address_____


2-WIRE CIRCUITS ONLY
2-WIRE PLUGS ONLY
Grounding contact electrically and mechanically connected to mounting strap for obtaining equipment ground through mounting strap and floor housing.
2 OR 3-WIRE CIRCUITS
3-WIRE CIRCUITS
1671 20A., 250V., 3 WIRE, GROUNDED
1672 "TWIST-LOCK", 3 WIRE, GROUNDED
1674 POLARIZED, 3 WIRE, GROUNDED
1675 N.E.M.A. GROUNDED, 15A., 125V. ONLY
1667 "TWIST-LOCK", 2 WIRE
1666 T SLOT, 2 WIRE
1669 20A., 250V., 3 WIRE
1670 "TWIST-LOCK", 3 WIRE,
1673 POLARIZED, 3 WIRE
T&B
1763
1810
Cat. #1793
1820
1830

New! T&B floor box receptacle

MATCHES YOUR CIRCUIT WIRING AND THE PLUG ON YOUR EQUIPMENT

Here's a convenient money saver from T&B . . . designed to make the use of many types of receptacles easier and more readily available. T&B receptacles (there's one for every need) fit all T&B floor boxes . . . and they can be changed in a matter of minutes should you later install equipment which requires a change in receptacles.

For full information on T&B floor boxes and receptacles, contact your T&B distributor today — he will show you how to save money on installed costs, save time, and safety-ize your job with T&B floor box receptacle combinations.

LOOK FOR THE SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-510

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

Catalogs, Bulletins and Engineering Data

(79) HINGED-COVER WIREWAY Type HW, each length and fitting completely accessible for lay-in wiring, is described in detail by new Bulletin GEC-1426-A. Available in even 1-ft through 5-ft lengths, the new wireway is available in three sizes, 4 by 4, 6 by 6, and 8 by 8 in. General Electric Co., Distribution Assemblies Dept.

(80) WALL-TO-WALL LIGHTING is pictured in 6-page fold-out. New packaged lighting system includes deep and shallow panels, circular panels, acoustic baffles and extruded aluminum suspension grid system. Sylvania Electric Products Inc.

(81) STAINLESS STEEL BRAZING. Bulletin GER-1331 is an 8-page reprint of a technical article discussing aspects of furnace brazing on stainless steels. General Electric Co.

(82) HEAVY DUTY RELAYS, either interchangeable or fixed multiple pole. Diagrams, dimensional drawings and photographs illustrate plug-in features, latching attachment, and convertibility from normally open to normally closed operation. Arrow-Hart & Hegeman Electric Co.

(83) DISCONNECTING SWITCH. Bulletin GEA-4980C, 8 pages, illustrates design advantages of new RF-2 disconnecting switches for sectionalizing and isolating circuits, including dimension data and ratings at which switches are designed to operate. General Electric Co.

(84) VENTILATORS for kitchen and bathroom, range hoods, and wall insert heaters are pictured and described in 12-page Bulletin 620N. Trade-Wind Motorfans, Inc.

(85) CHEMICAL PROTECTION for electric motors and other electrical apparatus. 24-page booklet discusses use of epoxy resins, answers questions on its application, and cites case studies of industries specifying its use. The Epoxylite Corp.

(86) CONSTANT POTENTIAL CONTROL for metal rolling and processing industries. Bulletin GEA-6318A, 4 pages, lists features of complete line; provides technical data on construction features, standard heights, ratings and dimensions; discusses functions of basic panels for dc motors. General Electric Co.

(87) AIR CONDITIONERS, completely self-contained, in six sizes from 3 to 20 tons. New 20-page Bulletin 6125 describes 1957 models, giving complete physical data including capacity curves, performance tables, V-belt drive recommendations, and condenser water recommendations. American Blower, Div. of American-Standard.

(88) FRACTIONAL HORSEPOWER MOTORS. Bulletin GEA-6424, 16 pages, illustrates design advantages and shows components in integrated insulation system of general purpose motors used on power tools, heating and ventilating equipment, compressors, fans, water pumps and machine tools. General Electric Co.

(89) SAFE SOLDERING AND BRAZING. Data Sheet D-445, "Hand Soldering and Brazing", presents up-to-date information on conditions or practices which, if improperly controlled, may prove hazardous. National Safety Council.

(90) CELLULAR CONCRETE FLOORS for office buildings are completely described in 32-page booklet. Included is design data for a typical 4-story office building and a typical 30-story office structure. Handily indexed, the booklet contains a section on structural design using the Flexicore floor system, a section describing the use of Conduflor electrical fittings to electrify the floor, and additional information on floor openings, fireproofing and suspended ceilings. The Flexicore Co., Inc.

(91) DC MOTOR-GENERATOR WELDERS. 4-page Bulletin GEC-1453 includes detailed product descriptions, specifications, performance curves, and other data on new 300- and 400-amp motor-generator welders. General Electric Co.

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(92) ENCLOSED CIRCUIT BREAKERS. 4-page bulletin covers enclosed molded case Cordon-type current-limiting air circuit breakers which afford fault protection up to 100,000 rms amperes in capacities of 100, 225, 400 and 600 amps, 600 volts. Hope Electrical Products Co.

(93) EXPLOSION HAZARDS. 8-page illustrated folder contains a check list of 13 questions designed to help determine whether uncontrolled flammable gases, vapors, dusts or liquids are making a particular plant unsafe. Crouse Hinds Co.

(94) LIGHTING FIXTURES. Four catalogs show complete line. Included is 36-page full-color residential catalog illustrating 1957 line of pull-down fixtures, traditional ceiling pieces with matching wall and ceiling brackets, new outdoor brackets and post lanterns, circlines, and two-tone bullets. Other three catalogs are devoted to commercial and industrial fluorescent fixtures. John C. Virden Co.

(95) SURFACE RACEWAY, comprised of two runs of metal duct under a single screw-type cover, is described in illustrated 4-page bulletin. Featured are photos of a finished installation and series of drawings depicting ease of mounting and wiring. National Electric Products Corp.

(96) ADJUSTABLE LIGHTING condensed catalog and price list contains over 150 illustrations as well as a complete description of every standard fixture and accessory. Swivelier Co. Inc.

(97) INDUCTION MOTORS. Bulletin GEC-1419 gives application data, types, ratings, frame sizes and construction features of dripproof and enclosed single-phase induction motors rated from ¾ to 5 hp at 115/230 volts, 60 cycles. General Electric Co.

(98) INDUSTRIAL LIGHTING standards, developments, new specification announcements, progress reports, etc., are to be covered in a periodical news letter. Requests for enrollment on complimentary subscription list are being accepted. RLM Standards Institute.

(99) LIGHT CONTROL EQUIPMENT for theatres, churches, restaurants, schools and other installations which require dimming, brightening and blending of individual circuits up to a total rating of 6000 to 15000 watts is described in new "Luxtrol" Bulletin L157P. The Superior Electric Co.

(100) INDUCTION BRAZING. Bulle-

WALTER D. VANCE, JR., *Vice President* • *California Electric Co., reports:*

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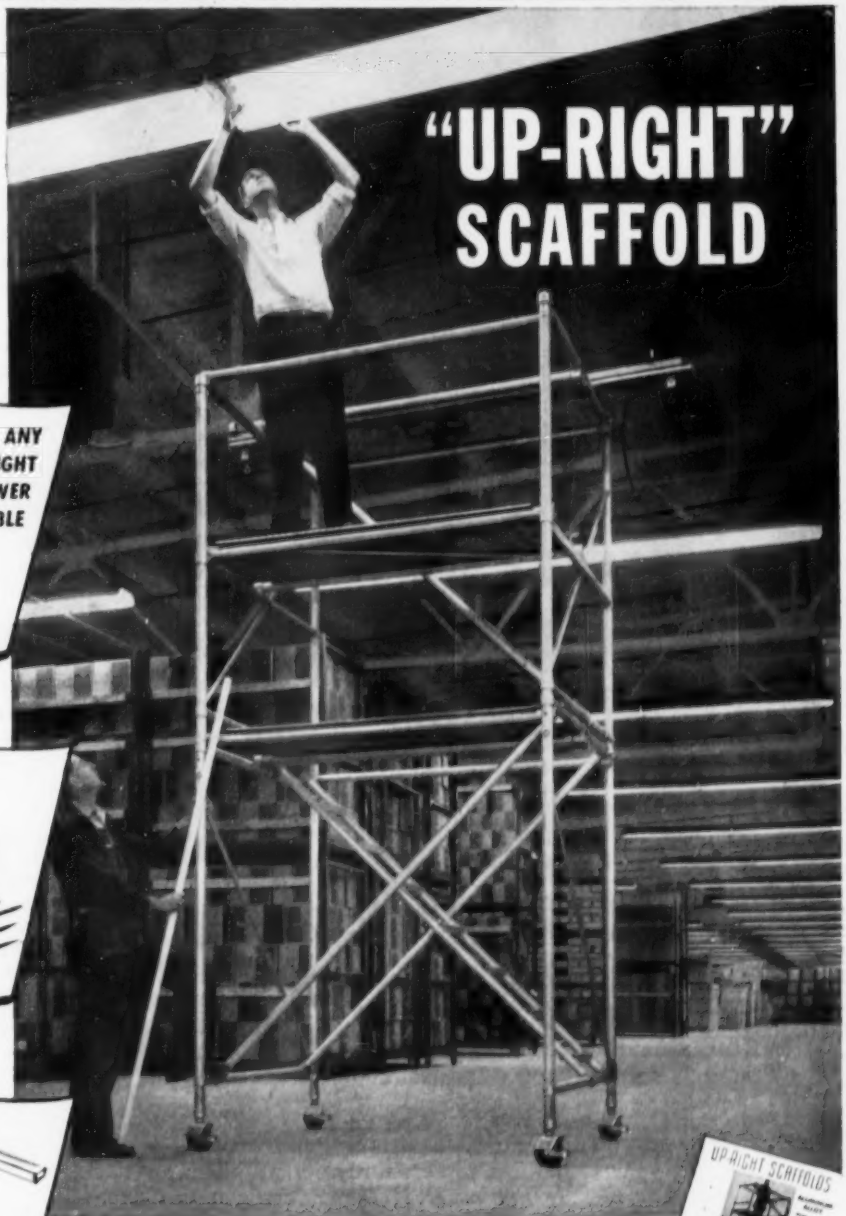
Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.



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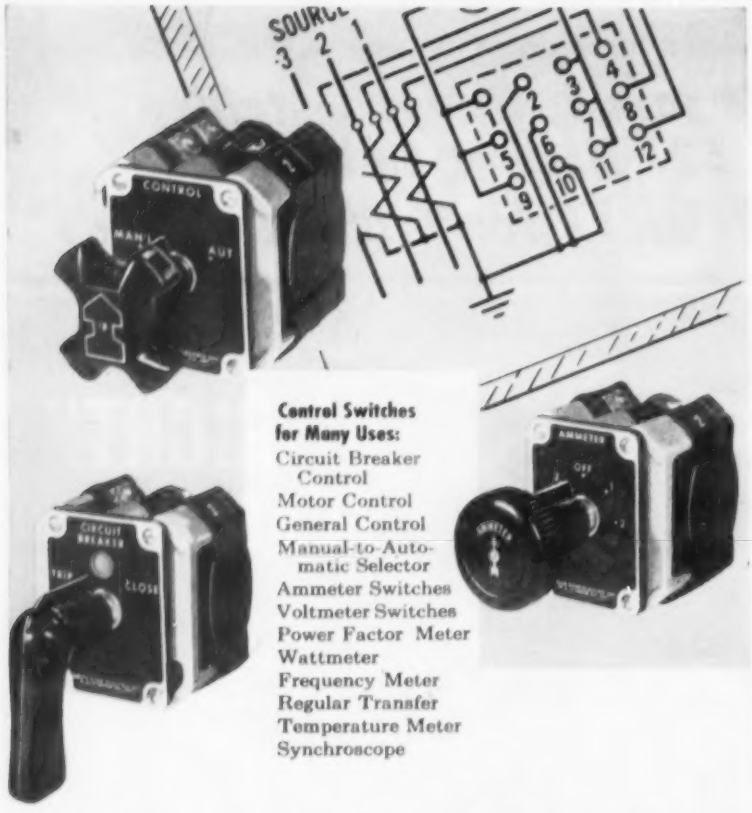
Factories: Berkeley, Calif. and Teterboro, N. J. • Offices in all principal cities



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Need rugged Control Switches? See Delta-Star's new line

These new Type M-2 Delta-Star control switches designed for D.C. or A.C. service give you important new features that mean improved operating efficiency and economy.

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Delta-Star now offers premium control switches at regular prices. Ask your Delta-Star representative about them or write *Delta-Star Electric Division, H. K. Porter Company, Inc., Chicago 12, Illinois. District offices in principal cities.*

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H. K. PORTER COMPANY, INC.

tin GER-1332, 4 pages, covers advantages, properties, formulas for estimating power requirements, and necessary tables for computing coupling efficiency for various metals and coil types. General Electric Co.

(101) OUTDOOR LIGHTING for residences. New Pathlite and twin receptacle power unit are described and illustrated in new 4-page Bulletin 135-57. Light unit is completely portable with aluminum ground spike and weatherproof cord set. Receptacles are protected by hinged gasketed covers to close receptacle openings when not in use. Steber Mfg. Co.

(102) FLUORESCENT UNITS are described and illustrated in new folders and catalog sheets. Included are the Twosome, featuring 45 by 45-degree compound shielding in shallow unit; Executive, a wide, all-steel louvered unit with self-illuminated sides; the Civic, an extruded aluminum-framed luminaire; and the Freeway, a plastic-enclosed unit ideal for corridor lighting or other long, narrow traffic areas. Smithcraft Lighting.

(103) LIGHTING EQUIPMENT, including sealed-beam lamp components, floodlights, gymnasium lighting units, high bay lighting, and service station lighting equipment and reflectors is completely illustrated in condensed Catalog CTC-2, 20 pages. Steber Mfg. Co.

(104) CONTROL CENTER manual, 16 pages, contains descriptive and pictorial information plus data on planning the installation and writing the specifications. Square D Co.

(105) MOTORS AND DRIVES. "The Moving Force of Industry" is a new 8-page booklet describing the complete line of ac and dc motors, gear-motors, motor-generator sets, motor controls and packaged mechanical and electronic adjustable-speed drives. Bulletin A-2501. Reliance Electric and Engineering Co.

(106) MASONRY DRILL and diamond coring bits for holes through floors or walls of brick, granite, tile, concrete aggregate, etc., for conduit or piping are described in new 4-page brochure. Diamond Products, Inc.

(107) MULTI-OUTLET SYSTEM. Circular 592 shows use of Plugmold system and accessories, listing benefits to contractors and users plus full description of size and capacity of systems for homes, factories and commercial buildings. The Wiremold Co.

A Profit Making Idea —the **Idea** of Light Control

Non-interlocking LUXTROL Type D2000 is shown in picture above

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THE TIME OF DAY

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This is a true story, and it might happen to you. An electrical contractor in a medium-sized Eastern city sold the owner of a restaurant on the *idea* of light control for one part of the restaurant. A LUXTROL D2000 was installed. One week later the owner was back. His customers' reactions had convinced him that it would pay him to control *all* his lighting circuits. The contractor had over a $1000 sale and a satisfied customer. And that is happening all over.

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Shock Hazard at Swimming Pools

QUESTION D32 — Recently, the following incident occurred at a swimming pool. The victim climbed a metal ladder and as he stepped from the ladder to the earth, he was the victim of an electric shock. Investigation disclosed that the motor on the recirculating pump had broken down and had charged the piping to the pool. The pool is of Gunite-type construction with a row of tile around the top edge. Apparently, the victim was charged as he climbed the ladder and the shock resulted from the discharge when he stepped to the earth.

The question now arises as to whether any advantage would be obtained in having a separate motor and circulating pump mechanically isolated from each other, instead of the integral unit involved in this installation. Further, the suggestion has been made to insulate the motor on the base and then insulate the coupling between the motor and the pump. These suggestions are made without too much consideration of mechanical and practical obstacles that might be confronted.

Aside from the pump, there is another possibility of charging the water in the pool because the pool is lighted by three underwater lights. These are unit type lights of 1,000-watt and 500-watt size imbedded in the sides of the pool. When it is necessary to replace a lamp, the entire unit is removed, raised above the water level, and a cover is removed to make the lamp accessible. The extension to the unit light is rubber cord that is pulled up through the water when the lamp is replaced. In time, the cord and gaskets will deteriorate, of course, and may provide a source of voltage underwater in the pool.

From considering this situation, it is apparent that the number of these small privately owned pools will increase. My questions are:

A) Is there any advantage in isolating the motor on the recirculating pump, as contrasted with applying the appropriate sections of the National Electrical Code to ground the frame of the motor?

B) What suggestions do you have for keeping the hardware and the water in the pool at ground potential so that there will not be a difference of potential between the metal ladder in the pool and the earth surrounding the pool?

C) Can you cite any specifications covering the construction and maintenance of the underwater lights?—A.L.D.

ANSWER TO D32 — The better way to insulate a system—(which is expensive and not too reliable)—is to *ground all* metal frames (whether electric or non-electric as long as the frames are used on the pool)—should be grounded to a common ground or water pipe if possible and when possible make your own ground rod system and tie all frames together to the water pipe which supplies the water to the pool.

Concerning the lamps, 1000 watts and the 500 watts, these, although sealed as they are, should have a third (green) wire to be connected to the frame of the box with a lug —making sure that the metal and wire are solidly grounded.

If all the equipments are solidly grounded, the leak in the pump motor winding or wiring will blow a fuse. The fault can be determined and corrected.

The size of the ground wire or rod is determined by your local code.—O.C.

ANSWER TO D32 — A. No. Grounding is much to be preferred in this case.

B. Bond all ladders, piping, motor frames, and all other non-current-carrying parts together and then ground the bonded group.

C. The principal thing which should be specified is that both the lighting fixture and the flexible cord supplying it be approved for this use and for this location, and that the cord carry an additional conductor for the purpose of grounding the fixture frame.—W.R.S.

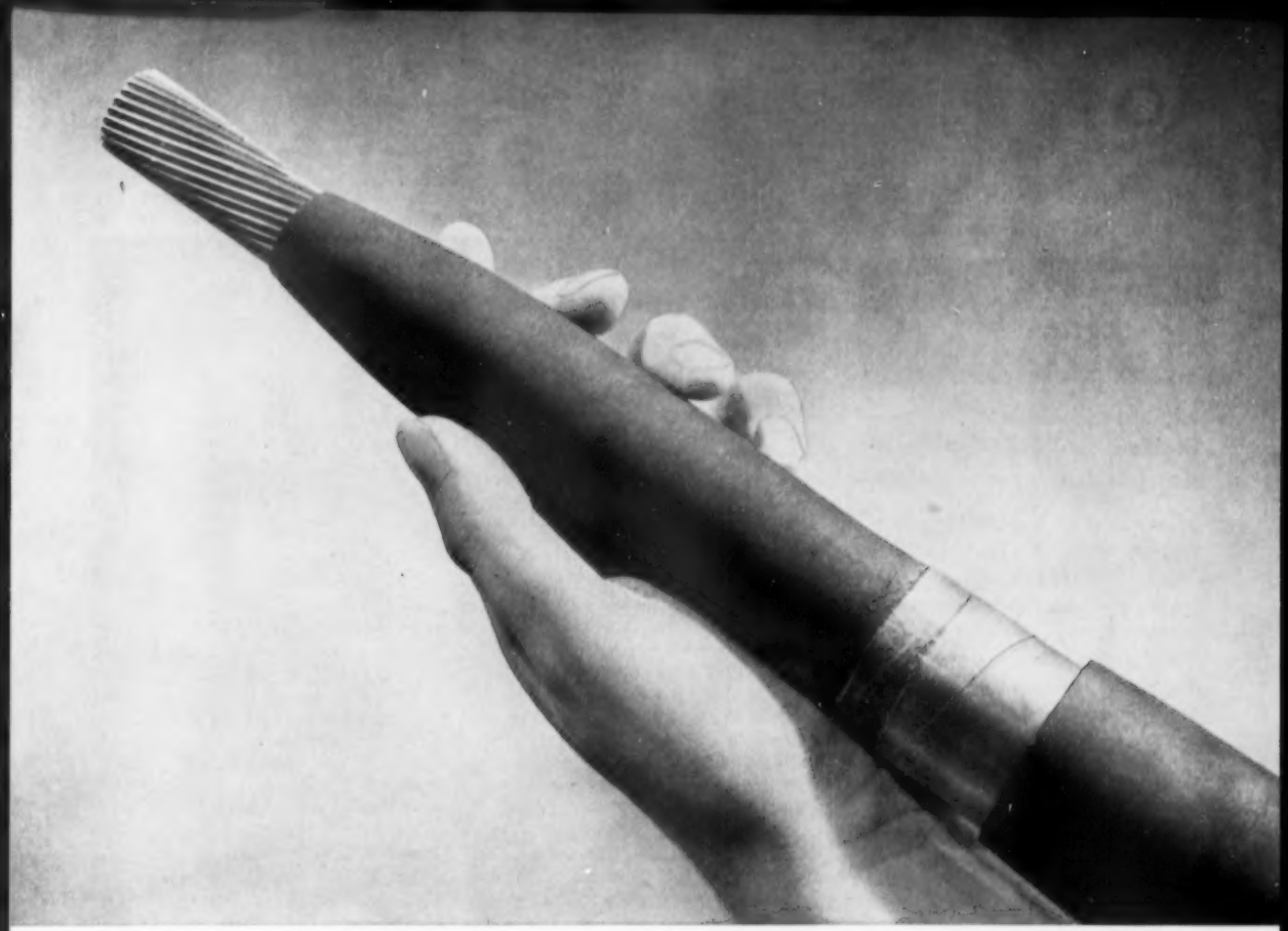
ANSWER TO D32 — Grounding the motor, pump, ladder, the reenforcing metal, the metal fence, the metal drain, the water pipes, the metal screen surrounding the lights and any other items that can supply a voltage above ground level will prevent shocks. By grounding I mean that it should be a good ground not only when the job is made, but also when the ground is asked to do a safety job. This grounding system will not protect if your neighbor or your city will string wires without grounded metal protection in the ground. I saw plenty of this insulation that cannot break down, both abandoned and a grade that was installed and connected in 1957. If this insulation should break down and liven metal or earth near your ground surface, then a shock hazard will exist. I do not recommend insulation that can get wet.—H.S.

Mercury Switches

QUESTION E32—I saw some mercury switches that have a 15-amp, 120-volt ac rating. Does this mean that all the mercury switches can control 15-amps with safety and durability?—H.S.

ANSWER TO E32—No. Some, in fact, most mercury switches have a much lower rating than 15 amps. Even those carrying a 15-amp rating may not be capable of interrupting the full 15 amps under certain conditions. On tungsten filament lamps in public places, for instance, the switches should also be "T" rated. For ballast type fixtures, unless specially designed and approved for the purpose, the switches must be limited to an ampere load of only half the rating of the switches themselves. Always be sure that switches are designed and approved for the purpose and for the location in question.—W.R.S.

ANSWER TO E32 — While I am unable to find a mercury switch rated at less than 15 amps at 120 volts, I also note that this rating does not include a "T" rating which means that these switches will not handle tungsten filament loads at the full rating. Also, ballast loads such as fluorescent lighting would impose severe duty on such a switch due to the inrush currents. Since incandescant lamps average approximately 800% inrush and ballast loads range from 160 to 200% inrush current; (based on full load operating current) the following is a good rule to observe:



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On ungrounded 440 v. 3-phase systems
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"For filament loads use only "T" rated switches and for ballast loads use a switch with twice the ampere rating of the load".—R.C.L.

Voltage Drops On 3-Wire, 1-phase

QUESTION F32—In many homes and commercial places, we find lights that brighten up when motor loads go on, also some lamps on one circuit will brighten up when lamps are turned on, on another circuit. Is this due entirely to an unbalanced load and what procedure should we take to correct it?—E.G.R.

ANSWER TO F32 — The effect E.G.R. has observed occurs when a change in current flow is made in the neutral, or common conductor, of a 3-wire feeder. The change in current flow causes a change in IR drop in the neutral conductor which causes the voltage to drop on that side of the feeder receiving the increased load and to rise on the other side.

It makes no difference what the loads were initially on the two branch circuits. The loads do not have to be balanced and in each branch circuit can be anything from zero to the maximum carrying capacity of the conductors. It is the *change* in the IR drop in the neutral conductor which causes the effect.

Consider this basic single phase circuit—If Load A and Load B are established and stable, and if an increase in current of I amps is made on Load A, there will be a change of IR volts drop in the neutral if R is the resistance of the neutral. If proper consideration is given to the direction of flow of the current, it will be seen that this IR drop change will be additive to the total drop on Circuit A and subtractive on Circuit B. Also note that there will be an equal amount of change in drop on L_1 conductor (if it has the same resistance as the neutral) but that there will be no change in the drop on L_2 conductor, so that the drop on Load A will be *twice* the rise on Load B. This will always be true regardless of the initial loads.

Correction of the effect can only be made complete by using a separate feeder for each of the two circuits; that is, discontinuing use of a common neutral. Loads on 3-wire circuits, especially where lighting is involved, should be kept as constant as possible, but do not necessarily have to be balanced. The feeder should be heavy enough to keep the drop to a minimum, especially on lighting loads and the neutral conductor should be as heavy as the "hot" lines. Motor loads should have their own feeders from the service panel, although where regulation of the power company's 3-wire service drop is poor (due to great length, smallness of conductors, etc.) not much can be done to improve matters without the power company's cooperation.

We were called in to correct a condition where lights in the most-used rooms of a residence would dim badly when the furnace motor started. The voltage drop at the lamps was 6 volts (5%) when the motor started. Due to the type of construction of the house, the contractor had run a long 3-wire feeder from the service entrance to the attic where it was split into two branch circuits with motor load on the circuit with the lamps in trouble. The best cure we could make, (aside from installing a difficult separate motor feeder circuit) was to put the motor on the opposite branch circuit which consisted of less important lights and plug outlets. This resulted in a 3-volt (2½%) rise in voltage on the first circuit instead of the 5% drop. The 3-volt increase in voltage caused an increase in voltage, caused an increase in brilliancy of the lamps, which was noticeable, but, in the opinion of the owner, was not as annoying as the 6-volt drop. It was not a proper cure but was all we were permitted to do because of economic conditions.—N.A.C.

ANSWER TO F32—There are two reasons for such conditions to exist. First, and the most probable one is a high resistance connection to ground or no ground connection at all on the three wire 120/240-volt system, and an unbalanced load.

The theory is as follows. To simplify the math required, assume a 100/200-volt system and 100-watt lamps with 100 ohms resistance. With two lamps in one circuit and one lamp in the other circuit, an unbalanced load is applied. With no ground, these lamps are in series across the 200-volt circuit. The total resistance is $\frac{100\times100}{100+100} + 100 =$ 150 ohms, and approximately 1.3 amps will flow creating a 65-volt drop across the two lamps and 135

REVERE ULTRA-LITES and "4200" SERIES FLOODLIGHTS *give even, shadowless illumination to this outstanding new super-service station. Ultra-Lites form square shaped light patterns which overlap to eliminate "dark spots". Service area illumination is 25 average foot candles, with a ratio of about 2 to 1 overall. In addition to advanced lighting, Ultra-Lites are themselves styled with an "advanced look" that adds much to the modern layout and architecture of the site.*

Revere Ultra-Lites are right for Chicago's "Auto World"

Revere has the right fixtures for your job too

Bright, even lighting is required by this large new service station to highlight its many services to the passing motorist. Revere Ultra-Lites were chosen because of their even, shadowless illumination.

For your job, too, you can select the exact components you need from Revere — because Revere has the widest line of matched fixtures for outdoor lighting. You can plan your installation with the assurance that all components will "fit" together in assembly. By ordering from one source, you are assured of well planned, complete deliveries to coincide with your job schedule.

Ask your electrical wholesaler to show how Revere fixtures can make your next outdoor lighting installation a more easily planned, more effective job.

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Once other contractors have cluttered up the work area, going back to remodel or finish a job is tough—unless you use RAMSET® FASTENING SYSTEM.

RAMSET reaches the hard-to-get-at places easily. One hand operation makes ladder and scaffold work simple. Does an hour's fastening in five minutes!

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companion tool

***Shure-Set*®**

a hammer-in tool that uses no cartridge, but makes your hammer power more effective. For masonry, mortar joints, cinder blocks. Ask for catalog.

Ramset Fastening System

WINCHESTER-WESTERN DIVISION
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across the one lamp. It is now obvious that the two lamps will be dim and the one will be bright. Now a second lamp is turned on in the one lamp circuit, with a total resistance of 100 ohms and 2 amps causing a balanced drop across each circuit. The dim lamp brightens and the bright lamp dims and all now give rated output. Therefore, check the system ground for good connection.

Secondly, on a single phase circuit, the use of capacitor-run motors may cause a rise in voltage if the circuit conditions are ideal.—J.M.

Winding Relay on 5-hp 1-phase Motor

QUESTION G32—While servicing a 5 hp, single phase, 220-volt, 1750 rpm blower fan motor, it was necessary to replace a defective potential relay with a new one in a wall mounted capacitor unit.

The motor manufacturer's instructions with the new relay cautioned that it should open the starting winding circuit between the motor speeds of 1350 to 1400 rpm.

By what means can this speed be accurately determined?—C.E.F.

ANSWER TO G32—The best way to determine if the relay opens at the proper instant—in opening the starting winding of single phase 5-hp 1750 rpm motor—at 80% of its speed, which is 1400 rpm: First, connect across the switch (in parallel with the switch) a 40-watt lamp. This lamp will not light up until the centrifugal switch opens (disconnects the coil from the line) thereby allowing a small current to flow through the lamp and the coil of the motor. At the same instant you have a speedometer on the end of the shaft of the motor and you release the pressure against the motor shaft and read the rpm the instant the light goes on.

There is another way to attain the same results, but, is a bit confusing in the way it operates, should you place the lamp leads in parallel with the coil; here the lamp will be lit when the power is applied and when the switch is opened the lamp will drop its brilliance and will continue to stay at a common brightness until the power is shut off. Here again, is the possibility of not getting the right results. The reason for the lamp to stay lit is that the rotor when spinning around is also cutting the

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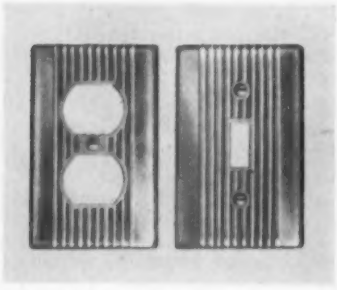
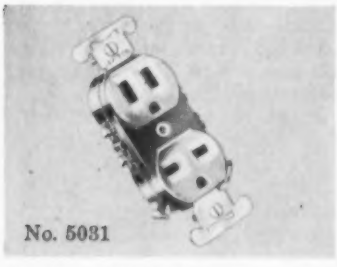
PRODUCT NEWS

New Leviton Wall Plates Have Clean Line Design



In step with today's trend toward clean, functional design, the new Leviton wall plates are smartly styled to complement any decorative scheme. Molded in rich brown phenolic or gleaming ivory plastic, these distinctive low relief design wall plates eliminate dust collecting problems . . . wipe clean in a jiffy. Complete range in 1, 2, 3, and 4-gang plates, with combinations to meet all wiring installations. Also available for Interchangeable Series Devices. Individually packed in cellophane together with necessary mounting screws. Meet NEC and Federal specifications.

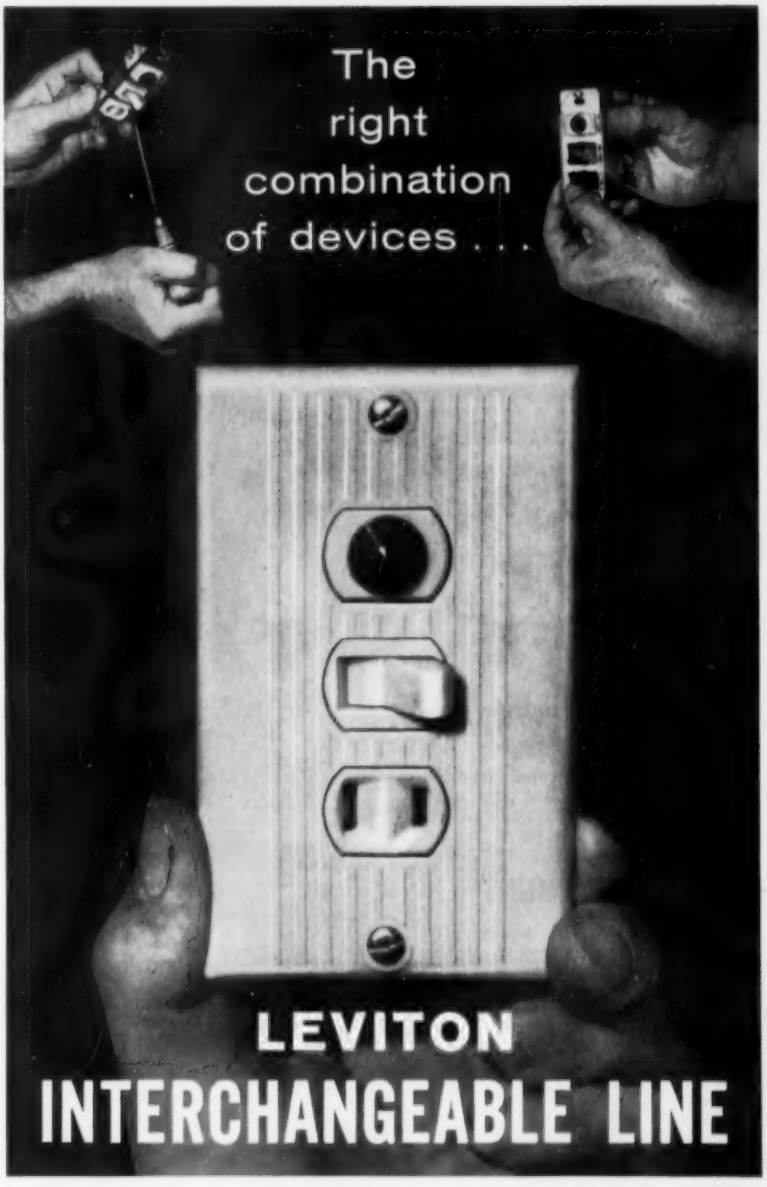


No. 5031

New U-ground Devices Added to Leviton Line

Among the many new items constantly being added to the U-ground line of Leviton specification grade devices are the duplex outlet combinations with parallel and tandem slots. These combinations are particularly applicable where 125V and 250V is required at one outlet. For use with air conditioners, portable power tools, washers and dryers. New and also available are single pole switch and U-ground outlet combinations. Meet all Federal specifications. Listed by U.L.

For complete information write Leviton Manufacturing Company, Inc., Brooklyn 22, New York.



Now, a newly designed series of devices that can be made up in combination and installed right on the job with a minimum of inventory and a maximum of efficiency. Any combination of one, two or three devices on a single gang can be assembled quickly and easily. Each device locks into the strap with a twist of the screw driver.

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Devices fit standard boxes and wall plates. Available in brown or ivory phenolic. Newly designed wall plates in metal or phenolic are simply styled, easily cleaned. Listed by Underwriters' Laboratories.

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Blackhawk's NEW One-piece Box Support

Speeds up work

Simple

A single piece that goes in easily and stays put — frees the electrician's hands for the work.

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The Blackhawk patented one-piece box support is installed all at once — permits more jobs, more profits.

Permanent

The Blackhawk box support provides rigid, unified support because it is a large, single piece — does not wiggle or saw, because it is parallel to the wall.

Superior installation in seconds

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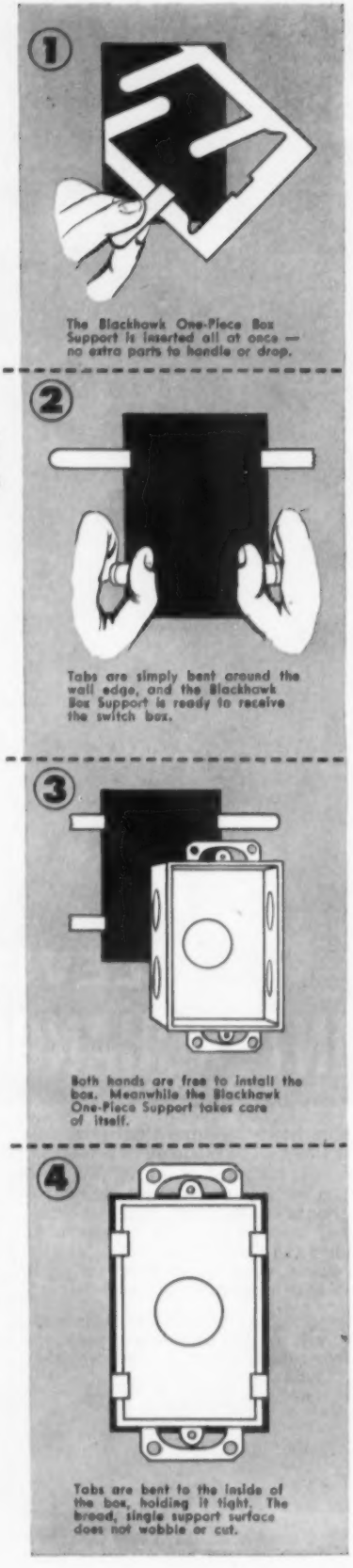
1
The Blackhawk One-Piece Box Support is inserted all at once — no extra parts to handle or drop.
2
Tabs are simply bent around the wall edge, and the Blackhawk Box Support is ready to receive the switch box.
3
Both hands are free to install the box. Meanwhile the Blackhawk One-Piece Support takes care of itself.
4
Tabs are bent to the inside of the box, holding it tight. The broad, single support surface does not wobble or cut.

magnetic lines of force and with the coil being closed by the lamp, in parallel, will build up a counter-electromotive force, thereby lighting up the lamp.—O.C.

ANSWER TO G32—I take it that CEF wants to determine whether or not the potential relay opens at motor speeds between 1350 and 1400 rpm.

If an ammeter is connected in the starting winding lead, and a tachometer is used to observe the speed, one can observe the tachometer reading when the meter reads zero.

Since the relay is of the potential type used with hermetically sealed motors and not a centrifugal switch used in standard motors, CEF can connect a light bulb on the motor side of the relay between the starting winding lead and a hot wire and note the tachometer reading when the light goes out.

He might observe a dim light when the relay opens due to induction in the starting winding.—B.A.S.

ANSWER TO G32 — Accurate speeds of rotating equipment may be easily determined with a stroboscope. A convenient instrument of this type is manufactured by General Radio Co. and is known as a Strobotac. It consists of a flashing light source controlled by a calibrated variable frequency oscillator. All that is necessary is to place a chalk mark on the pulley or shaft and observe the *highest* dial reading that gives a *single* stationary image of the mark on the shaft. To determine at what instant a motor reaches a certain speed merely set the dial at the desired speed and note whether or not the mark comes to an apparent stop at the right setting.

Lacking the above equipment one could use an audio oscillator and amplifier driving a neon light.—R.G.

Can You ANSWER These QUESTIONS?

QUESTION R32—In our plant we have a 3-phase, 3-wire delta 240-volt power distribution system. For lighting we connected a delta-star bank of transformers. Now, we do get 120 volts necessary for lighting, but checking further, we found that we are getting only about 208 volts between phases, and this is with no load. Will someone explain this phenomena?—J.M.

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deliver more light per foot of lamp length!

HI-OUTPUT "D-8500" LINE FIXTURES by Wheeler—designed for use with 100 watt and 60 watt rapid start lamps operating at 800 MA.

Diffuser apertures provide a small upward component of light to relieve severe brightness contrast . . . and allow for heat dissipation.

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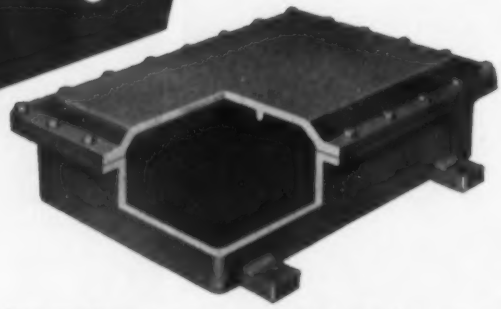
cast aluminum



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Lightweight, easily mounts onto equipment. Drilled and tapped to specifications. Made to Underwriters and Military Specifications.

Send for Bulletin F

THE Adalet MANUFACTURING COMPANY
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QUESTION S32—I have a large building to wire, which is constructed entirely of white cinder blocks. There will be plaster or stucco on the inside wall or partitions. They are to be painted.

All wiring is to be concealed and all outlets are to be flush. I therefore intend to use all UF wire going down through the inside of the blocks. The owner does not want any patching done around the edges of the boxes, as the patches would show up against the normal white color of the blocks.

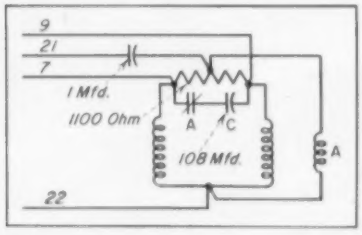
My problem is how to keep wall case or box in the cinder block from either falling out of the block when a plug is pulled from the outlet, or falling in the block when a plug is pushed into the outlet. This will also apply to wall switches for the overhead lighting. All power outlets are to be buried in the floor.

At first I was going to use thinwall but the owner does not want any surface work at all.

Do you know of a holder that will do what I want it to do, that is, keep the box locked tight in the cinder block?—J.P.W.

QUESTION T32—We are designing some portable test equipment which will include a 15 hp, 3-phase, 220-volt motor and a transformer to supply it from a 550-volt bus duct. Can someone suggest the considerations involved in sizing the transformer? There seems to be a difference of opinion among transformer manufacturers.—R.E.B.

QUESTION U32—Below is a diagram of a master Reversing valve motor. I would like an explanation for the action of relay A. There is



a constant voltage across leads 21 and 22. Voltage is applied to 9 or 7 to drive the valve in the direction desired. 9-7-21 are of the same polarity.—V.W.B.

PLEASE SEND IN YOUR ANSWERS BY AUGUST 15

Do you worry about plant expansion wiring costs
WHILE YOU'RE WAITING FOR A TRAIN?

If you're worrying about the costs of a new power distribution system — either in your present building or in that new plant you're planning — here's one way you can cut down on the worrying. Just specify Rockbestos A.V.C. (asbestos, varnished cambric insulated*) Interlocked Armored Cable. It will not only assure you of dependable service but will help you cut costs several ways. Here's how:

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Combination Starters...

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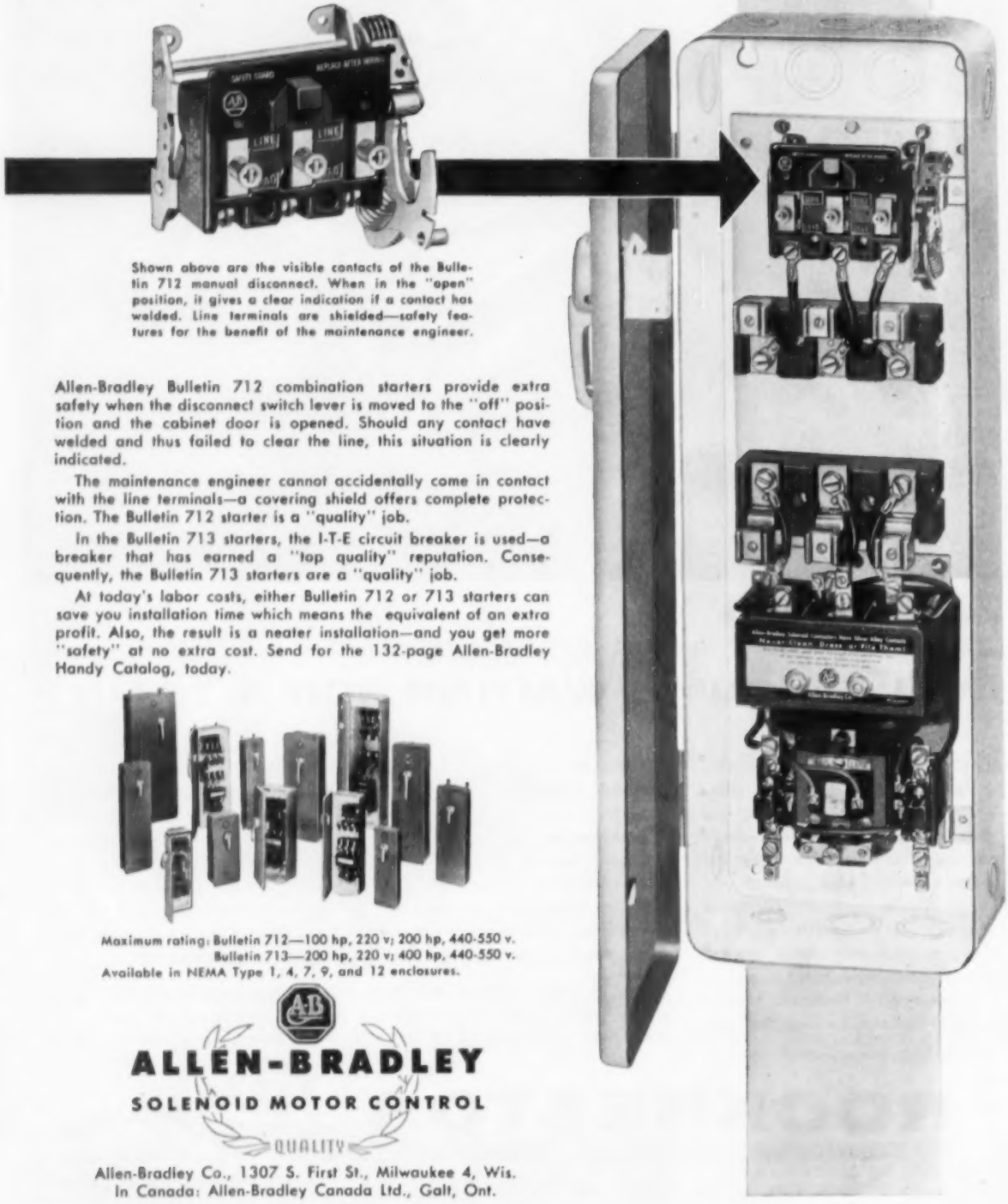

Shown above are the visible contacts of the Bulletin 712 manual disconnect. When in the "open" position, it gives a clear indication if a contact has welded. Line terminals are shielded—safety features for the benefit of the maintenance engineer.

Allen-Bradley Bulletin 712 combination starters provide extra safety when the disconnect switch lever is moved to the "off" position and the cabinet door is opened. Should any contact have welded and thus failed to clear the line, this situation is clearly indicated.

The maintenance engineer cannot accidentally come in contact with the line terminals—a covering shield offers complete protection. The Bulletin 712 starter is a "quality" job.

In the Bulletin 713 starters, the I-T-E circuit breaker is used—a breaker that has earned a "top quality" reputation. Consequently, the Bulletin 713 starters are a "quality" job.

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Questions on the Code

Answered by:
B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Locating Service Equipment

Q. *In a large residence now under construction our underground entrance comes from the service pole about 20 ft to the cement slab bedroom wing, under the cement slab about 30 ft to the basement. Immediately inside the basement we have established the main panel with a 150-amp main disconnect.*

Our local authority maintains that the point the conductors enter the cement slab constitutes entry of the building, and because of the 30-ft distance to our main panel, we must provide a main disconnect on the service pole. I maintain that the entrance under the cement slab bedroom wing constitutes no hazard and the code requirement pertaining to the distance inside a building before a disconnect is required does not pertain, or at least could be relaxed, to allow the main disconnect in the basement to be adequate.—H.A.R.

A. I have endeavored to portray through illustration, the factors involved with your service code problem as I understand them. Some of the details however are vague and some assumptions must be made. I assume that the underground lateral runs from the point "A" to the building wall at point "B". I assume there is a small excavated space under the concrete slab which forms the floor of the bedroom wing, and the service entrance conductors run exposed and attached to the slab a distance of 30 ft to the service equipment located in the basement.

Under such conditions we do have 30 ft of unprotected S. E. conductors inside the building, and it appears that the inspector is correct in his ruling. In support of this opinion I quote O. I. No. 387, issued October 10, 1952, which covers a similar question:

"Section 2351-A. Unprotected Service Conductors.

"Statement: A single family dwelling constructed on concrete and cement block foundation walls has a 2-ft crawl space, between the bottom of the floor joists and the ground, with no basement. The building is served by overhead service drop conductors with meter installed on outside building wall.

Question: Is it the intent of Section 2351-a to permit the service conductors to be installed in the crawl space secured to the bottom of the floor joist extending a distance of 40 ft to the service disconnect in the utility room?

Answer: No."

If however the underground service conductors continued underground from the building wall, point "B", to the service equipment at point "C", I do not believe there would be any code violation.

While the above Official Interpretation expresses the intent of Section 2351-a, there appears to be a conflict with respect to the hazard involved, as evidenced by the fine print note following Section 2331 which reads as follows:

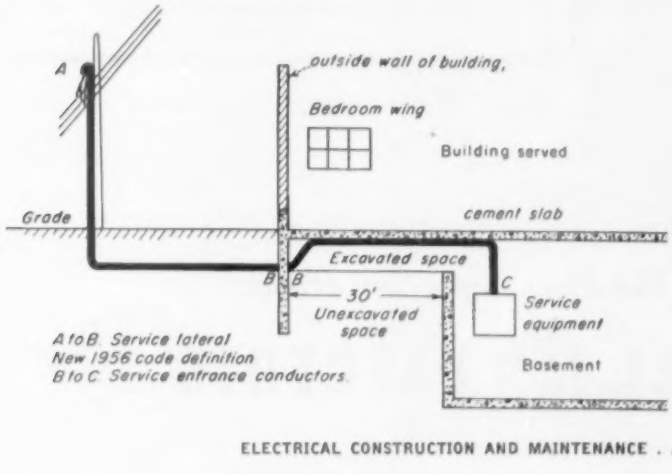
"Service entrance conductors should not be run within the hollow spaces of frame buildings unless provided with automatic overcurrent protection at the outer end."

This note implies that service entrance cable or a service conduit could be run concealed within the hollow space of a frame wall, without overcurrent protection at the outer end. In some cases such services could range from 15 to 30 ft in length. To me this code implication conflicts considerably with O. I. No. 387.

In the case in question there appears to be no combustible construction involved, outside of the possible storage of combustible materials. As a result the fire hazard is considerably less than that which prevails when the service conductors are installed in the hollow spaces of frame construction. Some inspection authorities have accepted the installation described by covering the service raceway from point "B to C" with 2 in. of masonry as recognized by Section 2302, or providing supplementary protection by an additional enclosure of non-metallic conduit such as Transite or steel conduit.

Regardless of code rules, I believe every additional foot of unprotected service in a building increases the hazard proportionately. When grounding connections are made several feet inside the building, any fault on the outside distribution system may be brought into the building and cleared through the building ground. Lighting, surges, etc. are involved. It is therefore highly desirable that our unprotected service conductors within a building wall be kept at a minimum length, so that a fault may be cleared as close as possible to the point where such conductors enter the building.

I believe the inspector's criticism is justified, but I also believe that the supplementary protection discussed above would tend to minimize the hazard, to the extent that an additional overcurrent device and switch would not be required at the pole.—B.A.McD.



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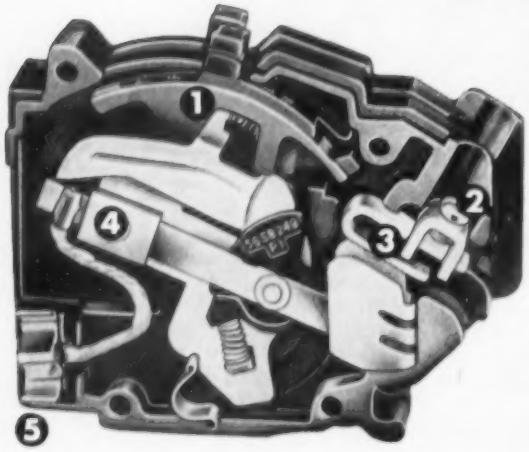

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5. Easier, quicker breaker connections. Protected self-aligning stab receptacle is spring reinforced—can't bend, plugs in without jiggling, grips tightly.

Now you can put more circuits into a smaller load center, because the new General Electric "twin" has two rugged breakers in a one-inch case! And because new G-E load centers are sequenced-phased, you can use "twins" and regular 1-, 2-, and 3-pole breakers in almost any combination. That means you can use smaller, less costly load centers than ever before possible. Here is a typical case:

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. . . eight 15- or 20-ampere single-pole breakers

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Total cost			$49.60
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Avoid skinned knuckles. Interior "snaps" in and out in seconds, giving plenty of room to swing a hammer or pull wires—inside the box.

Mount box fronts fast. Fronts hook on like a picture, lock with just two captive screws.

Enjoy automatic front alignment. Spring-mounted, snap-out interior "gives" with pressure, levels breakers automatically—even when box is off plumb.

These contractor shortcuts will save you 20 per cent in job time, as proved by actual contractor tests.

Interior "snaps" in and out in seconds for full wiring room. Interior mounts on springs, "gives" with pressure, automatically lines up breakers with front even when box is off plumb.

From 40 to 200 amperes, from 2 to 40 circuits G-E's 45 new load centers will cover every job. Have your G-E distributor show you the new load centers and the "twin" breaker. See for yourself how to get more quality circuit breakers into a smaller load center, in more circuit combinations, at the lowest cost. *General Electric Company, Circuit Protective Devices Department, Plainville, Conn.*

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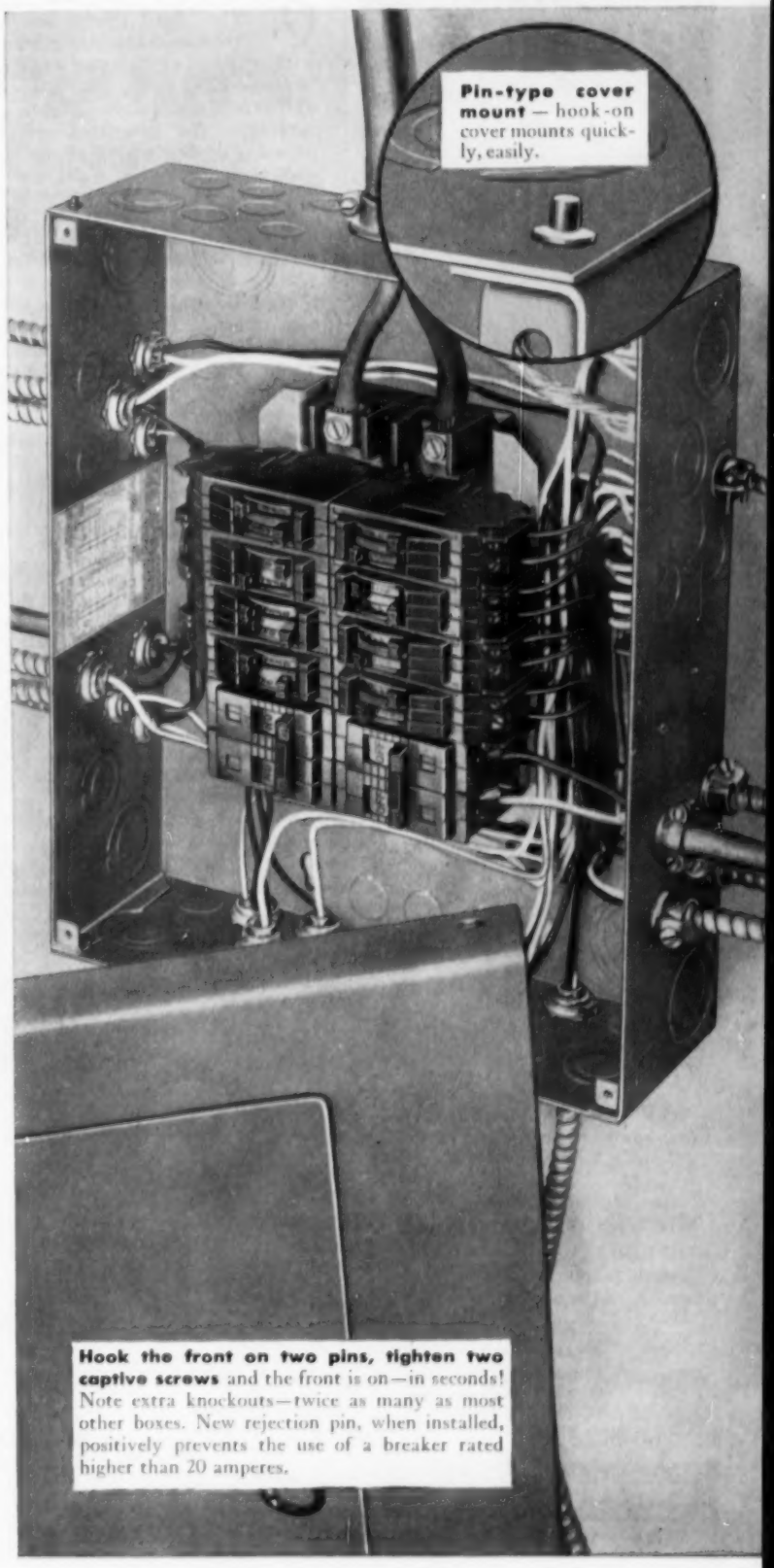
Pin-type cover mount — hook-on cover mounts quickly, easily.
Hook the front on two pins, tighten two captive screws and the front is on—in seconds! Note extra knockouts—twice as many as most other boxes. New rejection pin, when installed, positively prevents the use of a breaker rated higher than 20 amperes.

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Conductors for Power and Light

Q. *When both power and control conductors are contained within the same raceway as is permitted by the Code, do the number of control conductors in any way determine the permitted carrying capacity of the power conductors? —M.M.O.*

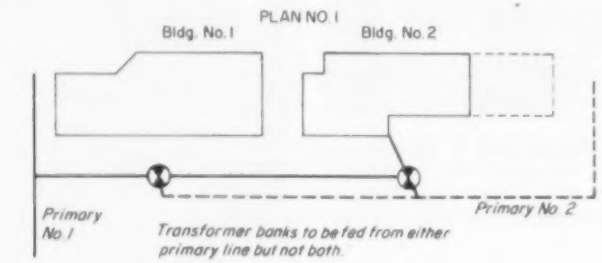
A. Section 7265 of the Code states that where four or more conductors carrying power or energy for lighting circuits are contained within a conduit in which control conductors are also located, the provisions in Note 4 following Tables 1 and 2 of Chapter 10 shall apply as determined by the number of conductors carrying power or energy for lighting and that those conductors used only for remote control may be ignored.—G.R.

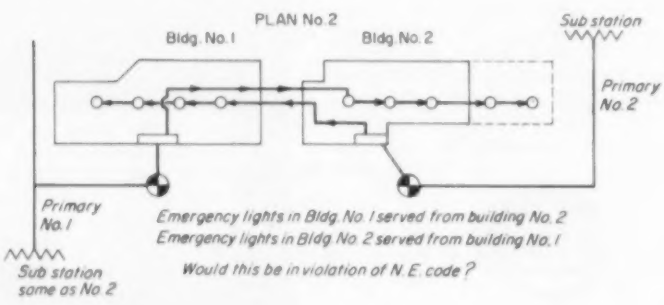
Emergency Lighting

Q. *Below are two plans for lighting two separate buildings, which are on sales days occupied by large groups of people (as high as 10,000). At present entire property is served by one service from No. 1 primary and is terribly overloaded and there is no emergency system at all. I have been asked if I would approve a new and separate service for No. 2 building fed from No. 1 primary. I felt I would or rather could give an approval, since Code would allow such an installation for several reasons —but I suggested No. 2 plan, whereby I could attain an emergency system for either building from the opposite primary lines.*

The owner is very much interested in No. 2 plan but I have now been questioned by other parties concerned as to the legality of No. 2 plan as opposed to No. 1 plan, since both No. 1 and No. 2 primary lines are served from same substation, which in turn is served by three other primary lines. I contend No. 2 plan is just as safe and dependable as No. 1 plan and also that the code would approve of an emergency system of this nature.—E.A.G.

A. Insofar as the Code provisions of Article 700, covering emergency systems, are concerned, I do not believe that the question of the primary is involved. Reference to the provisions of 7011 through 7015 indicates that the Code would be satisfied when two separate sets of secondary service entrance conductors are served through one transformer bank and a single primary. The reliability of such an emergency design is poor when compared with the isolated sources of energy provided through storage batteries or generator sets, so arranged that the power is automatically transferred from the normal supply to the emergency when a failure occurs on the primary lines, the transformers, or the main secondary service conductors and equipment. Insofar as the Code provisions are concerned either of the two plans presented could be used to satisfy the provisions of Article 700, and the reliability afforded by two primary lines, even though they were served




PLAN No. 2
Sub station
Bldg. No. 1
Bldg. No. 2
Primary No. 2
Primary No. 1
Emergency lights in Bldg. No. 1 served from building No. 2
Emergency lights in Bldg. No. 2 served from building No. 1
Would this be in violation of N.E. code?
Sub station same as No. 2

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through the same substation, would be far greater than the minimum set by the code.

As I understand the diagrams submitted, we have on plan No. 1 two primary lines feeding two sets of transformers with no arrangement for the automatic transfer from one primary to the other in the event of failure of the normal supply. As a result, we would not have emergency lighting immediately in the event of a fault on the normal primary supply. If the primaries were connected through an automatic transfer switch, emergency lighting or power would be available immediately. In either case however the provisions of the code would be satisfied as already covered by separate secondary services connected to one primary. In this case, if primary No. 1 fails we could obtain power from primary No. 2 either automatically or manually. If however transformer bank No. 1 fails or the main secondary service fails, the additional primary would be of no value unless the emergency lighting was arranged to be served through either primary as shown on Plan No. 2. The principal advantage of bringing both primaries to both transformer banks would be the assurance of more reliability of service in the event of a primary line failure.

In the case of plan No. 2, separate primaries are brought to separate banks of transformers which serve each individual building, and the emergency lighting in each building is served through the service which supplies the other building. In the event of a primary line or transformer failure on one service, the emergency lighting will continue to function in the building involved, but the emergency lighting in the other building will fail to function unless it is connected by an automatic transfer switch to the normal service of the building. This could be serious since exit lights and all other lighting essential to provide an illuminated path of egress from the building would be disconnected. In support of this statement, I am visualizing a building more than one story in height with cut-off stair wells or possibly fire escapes. While the general lighting would continue to function the emergency lighting would be discontinued. Regardless of the foregoing comment, the system shown by plan No. 2 would satisfy the minimum code requirements.

I personally believe that your design, covered by plan No. 2, will afford maximum reliability of the emergency system of lighting far beyond the minimum requirements of the code, and the one weakness which I have covered above could be satisfied if an automatic transfer switch was installed on each set of emergency lighting so arranged that in the event of power failure on one service the emergency lighting in the other building would be transferred to the normal service. —B.A.McD.

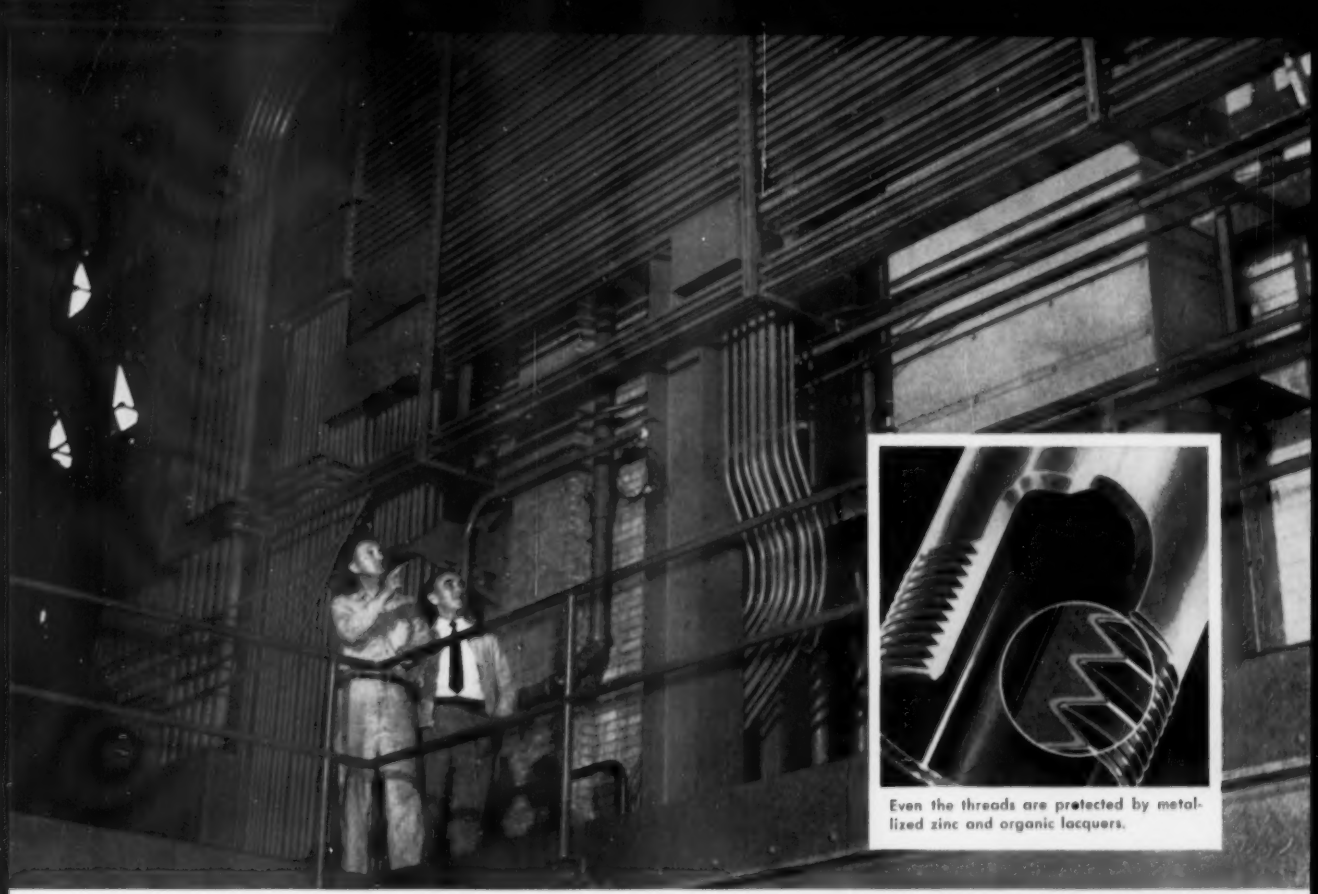
Troughs

Q. *I have been asked to accept an installation in a rather large building here where open conductors will be laid in Cope troughs from a transformer vault through a basement for approximately* 100 *ft to a vertical shaft where they will terminate in transformer vaults on every other floor. These conductors will carry* 4160 *volts and while the conductors are insulated for the voltage involved, I have taken the position that they are not inaccessible to unqualified persons and therefore cannot be run through the open in the basement in this Cope trough. Am I correct in this stand?—M.C.A.*

A. Section 7105 of the National Electrical Code is most specific in stating that circuits operating at voltages in excess of 600 volts between conductors shall be installed in rigid metal conduit in raceways or ducts or as open runs of metal armored cable suitable for the use and purpose except that in locations accessible to qualified personnel only, open runs of nonmetallic sheathed cable may be employed. Therefore, if the Cope trough used is in that portion of the basement where it will be accessible to other than only qualified personnel, you are correct in your assumption that its use would be a violation of the Code.—G.R.

Six Sets—Service Equipment

Q. *Below is a sketch for the single phase* 120/240-*volt main distribution panel designed for an existing hospital which we are remodeling and enlarging. The local inspector will not approve this layout because he says it is not in accordance with the code, Section*



Even the threads are protected by metallized zinc and organic lacquers.

At the New York City Transit Authority's 74th Street Power Station, Milton W. Leslie, left (General Foreman, Hatzel & Buehler) discusses the rigid conduit installation with Louis Margolis, right (Hatzel & Buehler Project Engineer). More than 30,000 feet of rigid steel conduit were used on the south wall of the turbine house alone. A portion of the installation is shown here.

G-E WHITE rigid conduit makes the job easier in one of the nation's largest conduit installations

Included among the many products used in the $45,000,000 expansion program at the New York City Transit Authority's 74th Street Power Station are more than ½-million pounds of G-E White, the rigid steel conduit that has proved a time-saver on wiring jobs throughout the world. Wherever used, G-E White provides electrical contractors with the same benefits—easy bending, easy wire pulling, zinc-protected threads, superior corrosion resistance.

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Severe space limitations made the modernization program at the 74th Street Power Station a difficult engineering job, creating special problems for the layout and installation of conduit. Numerous elbows and offsets stressed the importance of easy wire pulling, bending and threading. Moreover, the conduit had to resist the corrosive effects of high temperature and humidity.

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Electrical contractor, on the work shown at the 74th Street Power Station, is the Hatzel & Buehler Electric Company, New York City. Design and supervision of construction is being performed by The J. G. White Engineering Corporation, New York City.

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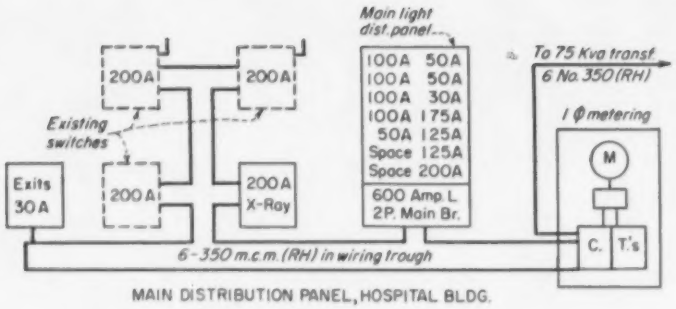

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2371-a-3 *(six breakers or fuses). The inspector says that this section is incomplete and can mean anything and means nothing at all concerning overcurrent protection. He objects to the fact that we have a total of* 1430 *amps for our six disconnects and breaker and that our wire has a capacity of only* 496 *amps (*310x2x80%*). This is due to our low demand factor (also allowed in the code, Section* 2203*).—A.H.S.*

A. Insofar as the N. E. Code is concerned there appears to be no violation with respect to the service equipment design covered by your illustration. The code has recognized for many years six sets of service disconnects and six sets of fuses or circuit breakers as suitable for the service disconnect and overcurrent protection of a building. This opinion has been verified several times by various Official Interpretations given over several years. The only possible violation concerns the last sentence of Section 2351-a which requires the service disconnecting means "to be of a type approved for service equipment and for prevailing conditions."

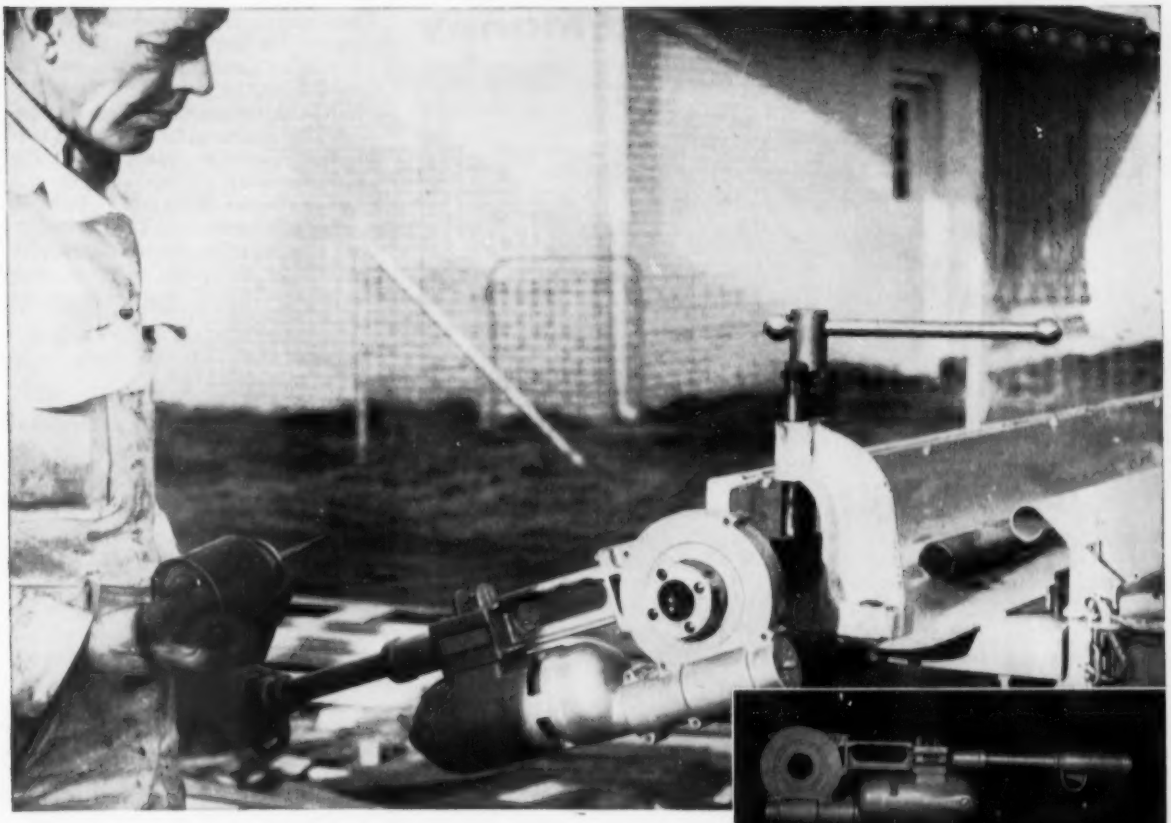
It is quite true that the provisions of Section 2371 will not limit the current that may enter the building over the service entrance conductors and it also follows that such conductors may be seriously overloaded. In the early days of our industry, when one main disconnect and overcurrent device was mandatory, we limited the current that could enter the building. Since then however, there is a question, in the minds of many who are concerned, regards the adequacy of protection derived through multiple sets of overcurrent devices, and the case presented appears to be an excellent example of this concept of protection. I do not believe however that the ratio between the switch and conductor capacity should be used to emphasize the point in question. Switches may contain fuses considerably less than the switch fuseholder capacity, and while I realize that such overcurrent devices may be readily increased to the fuseholder capacity, it appears to me that a fair evaluation of the situation should be based on the ratio between the combined service overcurrent devices and the service conductor capacity.

Insofar as code rules are concerned, there is no apparent code violation involved with your service design; but I sincerely agree with the inspector that the service entrance conductors may be seriously overloaded, possibly beyond the original intent when the rule was formulated. Many inspectors located in various parts of our country have a similar opinion, and in some cases our design engineers have recognized this factor and tempered their designs.—B.A.McD.

Wiring for Terminal Elevator

Q. *A local terminal elevator is being converted from a rope drive to an individual motorized unit, making it necessary to run feeders for some* 1500 *hp which will be located on the garner floor and head house. Would it be possible to use busway for this feeder rather than employ rigid conduit?—V.G.*

A. A busway cannot, of course, be run through any Class 2 location, as Section 5054 specifically states that in a Class 2 Division 1 location wiring shall be in rigid metal conduit with threaded boxes and fittings. However, it would be possible to use busway if it were run up the outside of this building and then run directly into a dust-free distribution room located on the floor containing the greatest motor load. Section 3642 states that busways shall not be used outdoors or in wet or damp



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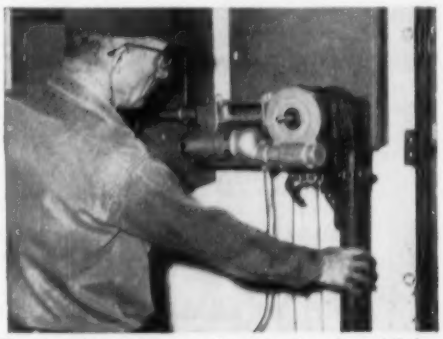

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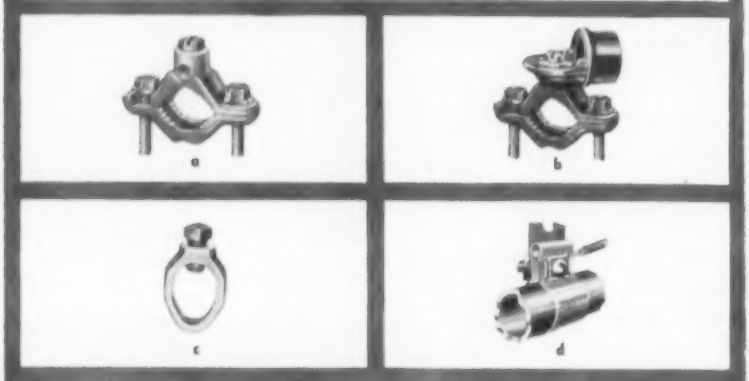

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locations unless specifically approved for the purpose. Therefore, it will be necessary if you use the busway on the outside of the building to purchase one which is specifically approved for outdoor use. Such busways are identified by the manufacturer on each length and fitting. Under Section 2331 you will note that permission is granted to use busways for service conductors extending along the exterior of a building.—G.R.

NEC Official Interpretations

A series of six official interpretations of the 1956 National Electrical Code have been reviewed and released by the Electrical Correlating Committee of the National Fire Protection Association. Effective date of the interpretations is April 26, 1957.

Subjects covered include: recessed fixtures; neutral bus capacity; branch circuit rating for cord-connected air-conditioning units; services to separate buildings; and use of insulated and isolated transformers for grounding protection.

The full official texts of these latest interpretations are as follows:

INTERPRETATION NO. 434

SECTION 4150: Recessed Fixtures

Question No. 1—Does Section 4150 apply to recessed incandescent fixtures?

Answer—Yes

Question No. 2—Does Section No. 4150 apply to recessed fluorescent fixtures?

Answer—Yes

Question No. 3—In the event that the answer to Question No. 1 is "Yes", may recessed incandescent lamp fixtures provided with outlet boxes which have terminal connections operating at temperatures in excess of 60°C be connected by a single circuit which passes through each outlet box of a line of fixtures?

Answer—Yes, provided the branch circuit conductors have insulation suitable for the temperatures encountered. See paragraph "a" of Section 4179.

INTERPRETATION NO. 436

SECTION 3018: Neutral Bus Capacity

Question—In a 3-wire feeder panelboard, does Section 3018 re-

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quire the provision of a neutral bus bar to extend the full length of the other bus bars and parallel to them?

Answer—No

INTERPRETATION NO. 437

SECTION 4293: Branch Circuit Rating For Cord-Connected Air-Conditioning Units.

Statement—A room air-conditioner with flexible cord connection is made with a heating unit as well as with a refrigeration unit and the design is such that the heater and the refrigerator will not be in operation at the same time. The nameplate rating of the compressor motor is 8.3 amps and the rating of the heating unit is 14 amps. The unit is intended for use on an individual branch circuit which would not supply lighting units or other appliances.

Question—Under the foregoing condition would a 15-amp branch circuit supplying a 15-amp receptacle comply with the intent of subparagraph 1 of Section 4293 of Interim Amendment No. 101?

Answer—No

INTERPRETATION NO. 438

ARTICLE 230: Services To Separate Buildings.

Statement—An existing school building has two services: one a single-phase, three-wire, 120/240-volt on one side to serve all the lighting; and a three phase, three-wire, 240-volt on the opposite side to serve a motor load. A separate building is being added and in order to serve this building, it is planned to change the 3-phase service to the main building to a 3-phase, 4-wire delta service to supply the motor load in the main building and provide a single-phase supply to the separate building. The single-phase service is not being changed in any respect.

Question—Is this proposed rearrangement contrary to the intent of Sections 2301, 2302, or 2321 of the National Electrical Code?

Answer—No

INTERPRETATION NO. 439

SECTION 2435: Overcurrent Protection In Air-Conditioning Units.

Statement—A self-contained air-conditioning unit is provided with enclosed type motor starters located in the air stream of the return and conditioned air. There are no combustible materials in the area where the starters are

mounted. There is also an enclosed fuse box in this same area. The fuses in this box are for the protection of the fan motor and control circuits in the unit. Access to these compartments is through snap-on panels in the enclosure of the air-conditioner.

The fuses specified by the manufacturer for the branch circuit to the air-conditioner are in compliance with paragraph b-3 of Section 4343 of the National Electrical Code.

The air outlets from the self-contained unit are connected to ducts for carrying the air to the location where cooling is desired.

The self-contained unit has been examined and tested by a laboratory of recognized standing and judged to be reasonably safe for its intended use.

Question No. 1—Is the provision of a snap-on panel over the compartment housing the fuse box and motor starter contrary to paragraph "a" of Section 2435 of the National Electrical Code?

Answer—No

Question No. 2—Does Section 2403 of the National Electrical Code apply to the rating of the protection for the conductors of the branch circuit to this air-conditioning unit?

Answer—No. See Section 4341

Question No. 3—Is it the intent of Section 3020 of the National Electrical Code to cover the construction of self-contained, factory built and wired air-conditioning units connected to air-conditioning ducts?

Answer—No

INTERPRETATION NO. 440

SECTION 2501: Use Of Insulated And Isolated Transformers For Grounding Protection.

Question No. 1—If a one-to-one ratio insulating transformer and a relay and circuit breaker are installed at a 120/240-volt, single-phase service entrance to a building, would this be acceptable as an alternative to the grounding of the neutral conductor, metal frames of equipment, etc. that would ordinarily be required by Article 250 for such an electrical installation?

Answer—No

Question No. 2—Is the term "isolation" as used in Section 2501 intended to refer solely to the definition of "isolated" in Article 100, "Not readily accessible to persons unless special means for access are used?"

Answer—Yes

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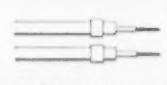

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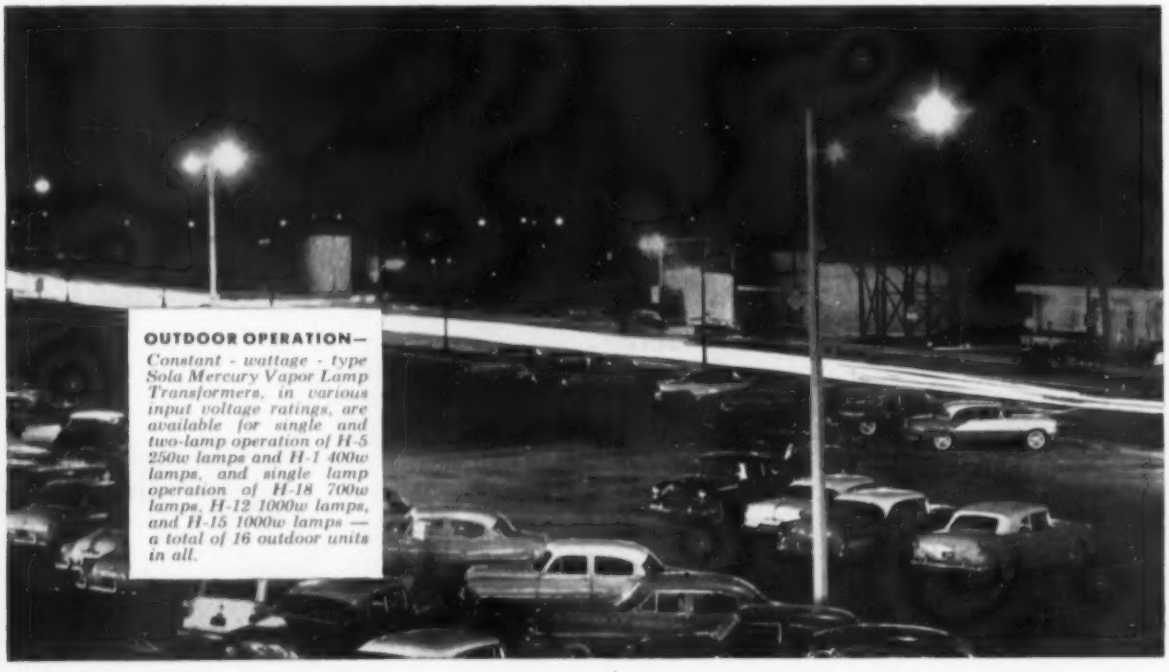

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In The News

Business Outlook at Midyear

Business will wind up this year at a faster pace with conservative inventories providing a safe footing for the economy.

The first half of 1957 has ended up with the gross national product at the annual rate of $430 billion. Government spending has been going up faster than predicted. On the other hand business has been showing extraordinary restraint and wisdom in the management of inventories. Reversing the usual practice of piling up inventory when the outlook for business is good, most companies this year have been cutting down on inventories—even though sales are rising. This conservative inventory policy has subtracted something from the volume of goods recently produced. But it has kept our prosperity on a safe footing. Since the only recessions we've had in recent years came about when inventories were dangerously high, the possibility of a major setback in 1957 has just about vanished.

(1) *Housing*—the weakest of the weak spots in the recent business picture—is due to get some help in the second half-year from a moderate improvement in the supply of mortgage funds. The annual rate of housing starts has been bumping down around 850,000, which is about as low as it is likely to go. In fact, this rate of homebuilding is barely sufficient to keep up with the new family formation.

There are close to 900,000 new families to be housed this year—including those moving off the farms into the city areas. And we are still knocking down old houses at quite a rate, to make room for new highways and office buildings—as well as to relieve eyesores and fire hazards. There are enough vacancies to take care of the extra demand for housing briefly, but not for long. So at least a modest upswing in residential construction seems to be called for.

We do not pretend to understand all the complexities of the process by which Congress and the Federal National Mortgage Association undertake to provide an increase in mortgage credit. But our scouts assure us that—while some of the more wild-eyed schemes are not coming to fruition—"Fanny Mae" will get up enough money to support a rate of 950,000 housing starts or better before the year is over. There will be a further improvement in this regard—we're told—in 1958.

(2) *The auto industry*, to the dismay of its own forecasting experts, is not selling any more cars or trucks than a year ago. But, as in baseball, there is "always next year"—which, in terms of auto model years, begins in September or October. There are almost as many new models due to come out this fall as in 1956. And it would be most surprising if some of them did not catch on better.

Some of the fundamental factors in demand for autos also will be more favorable later in 1957. Consumer income is rising steadily, and the price of new cars is not likely to go up as much as in recent months. Also, a large number of families will have reduced the debts outstanding on their present cars, and so be in a better position to trade. The big group of 1955 used cars is getting older. And, by this fall many of them will even be paid for. The ability of families to take on new installment debt is probably the most important factor in auto sales today. And this ability will clearly increase enough to support some gain for the industry.

(3) One of the weakest markets for durable goods—*agriculture*—may also be perking up. The Department of Agriculture has predicted a 4% rise in farm income this year. And this should lead to a rise in purchases of farm equipment and light trucks—as well as in farmers' spending for new automobiles.

(4) *Other consumer durables* have been selling poorly, for reasons no one seems able to explain fully. However, if merchants keep on providing easy credit and discount prices—and there is every sign that they will do so—sales of appliances and furniture should soon begin to move up in line with incomes. There will also be some stimulus over the next year from a moderately higher rate of new home construction—which provides a big market for the appliance and furniture industries.

All this may add up to a much better performance by the consumer in the second half of 1957 and in early 1958—even if the average family continues to exercise some restraint in spending and keeps its savings high. Savings have been running close to 7% of consumer income after taxes so far in 1957. And it is worth noting that, at current levels of income, even a 1% drop in saving would mean over $3 billion more spending. If the public generally got a taste of easier credit and tax cuts to come, such a shift to freer spending might well take place.

It is not clear whether the federal government—which has the say on tax and credit matters—is prepared to add much fuel to a revival of consumer buying in the months just ahead. The fact that elections are held in even years would suggest that any such fuel might well be saved for use beyond 1957. And in fact, the latest advice from Washington does not indicate any important change in tax or credit policy this year. The most influential members of the tax-writing committees seem to be strongly against tax reduction this year—or even for January 1—until the rise in federal spending shows some signs of leveling off. The way our military program is going, such signs will be hard to find in the next few months. Meanwhile, the Federal Reserve Board has been keeping bank credit under a tight rein and stating publicly that it will keep on doing so.

NECA District No. 1 Conference

The 11th annual progress meeting of the National Electric Contractors Association, District No. 1, was held at the Equinox House, Manchester, Vt., June 10-12. More than 300 members and guests registered. Speakers on the program stressed the importance of writing clear specifications, the need for more apprentice training programs, better estimating methods and training in management.

The sessions were presided over by A. V. Bartlett, Sr., vice president, District No. 1, and Gerald J. Connor, president, Boston Chapter. The host chapters were Northeast Massachusetts, Boston, Western Massachusetts, Central Massachusetts, Rhode Island and Southeast Massachusetts.

Frank W. Crimp, a member of the firm of architects of Adden, Parker, Clinch and Crimp, Boston, spoke about "The Architect and the Contractor". He told about the work being done by the Contractors Specification Institute, which is devoted exclusively to improving construction specifications. The CSI was organized ten years ago by a small group of specification writers and now has 1600 members and 16 chapters located all over the country.

Specifications, Mr. Crimp said, should be clearly written and followed. Actually specifications describe the quality of job that is expected of the contractor. Some of the points being studied by the CSI are trade standards, covering minimum standards of materials and methods; trade jurisdictions; careful use of words, as words have different meanings in different parts of the country; discarding the term "or equal"; a specification outline; recommendations as to design and layout standards.

JOHN DORIS, New York City, and G. L. Chadwick, Lord Electric Co., Inc., Boston, Mass., attended the sessions of the District No. 1 meeting at Manchester, Vt.

Bill Damon, director of the Joint Apprenticeship Training Committee of NECA and IBEW, gave a brief report on the activities of the program, urging that more apprenticeship courses be held. He also spoke on the manpower shortage, emphasizing the responsibilities that both management and labor have on the manpower problem.

There was a Technical and Training Services panel presentation with Floyd Taylor, New Jersey Research Committee member, reporting on the activities of the research program; Jack Kiernan, Chapter manager, Nassau-Suffolk Chapter, describing the very successful estimating class conducted last year in Long Island.

AT SPRING MEETING of District No. 1, NECA, were S. J. Cristiano, NECA field director, New York; Frank W. Crimp, an architect from Boston; Clint J. Harder, secretary-treasurer, NECA, Washington; A. V. Bartlett, Sr., vice president, District No. 1, Providence; and Gerald J. Connor, president, Boston Chapter.

Spokane Group Urging Change in NEC Demand Tables

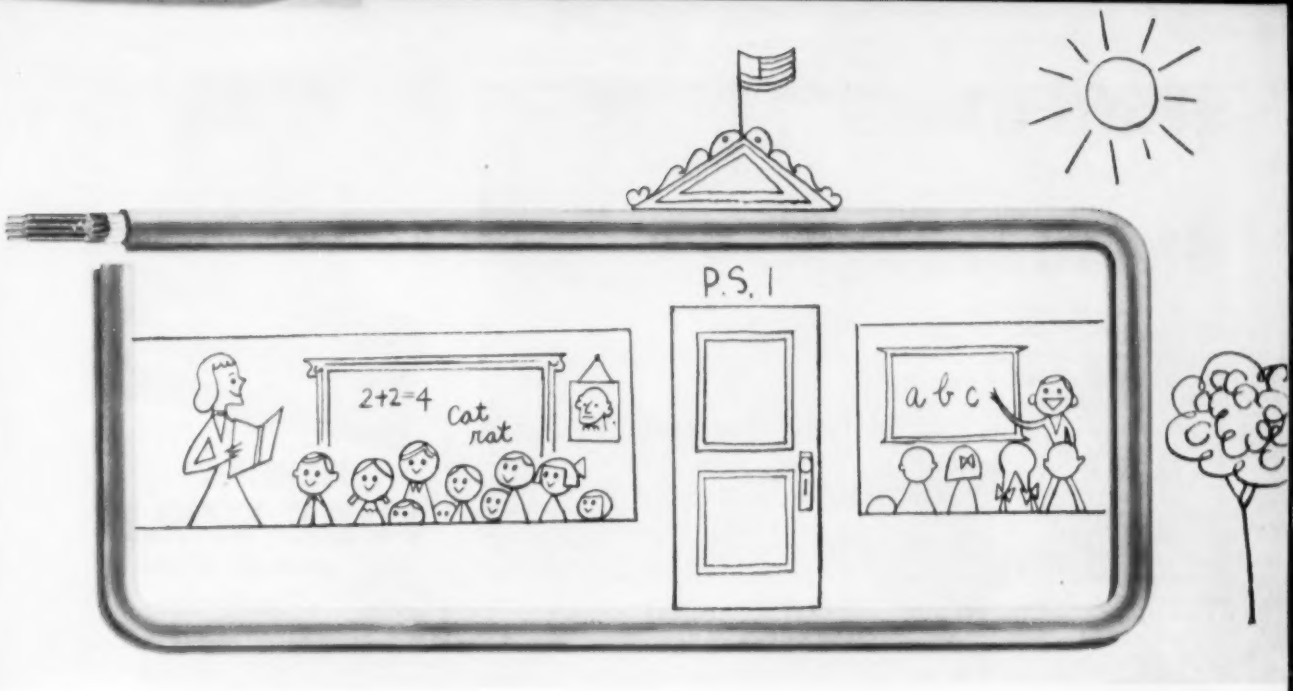
A movement to change the National Electrical Code demand tables in respect to residential loads has been started from Spokane, where the movement for a 200-amp service entrance equipment also first started. The movement is substantiated by results of demand meter load tests on completely electrified homes, not only in the Spokane but in the Longview and Portland areas. These studies tend to show that the demand levels off after a certain saturation of appliances, evidently because of the diversity of use. This applies even where complete electric heating is involved.

The movement was officially launched at the Business Development Section annual conference of the Northwest Electric Light & Power Assn. at Vancouver in early May. James Paxton, chief electrical inspector of Spokane, was presented by Gordon DeFoe of Washington Water Power Co.

What Paxton proposed is that the demand load for single or two-family dwellings using electric ranges be calculated as the sum of 11 kw plus 35% of the connected load in excess of 11 kw. The connected load is assumed to be equal to the sum of 3 watts per sq ft of floor area plus 1,500 watts for small appliances, plus 12,000 watts for an electric range plus the sum of the wattages of all additional connected appliances, including water heater, clothes dryer, incidental space heaters, furnace and similar permanently connected appliances.

Accompanying Paxton to the Vancouver meeting were H. H. Watson, General Electric Co., Schenectady, chairman of the code panel; O. K. Coleman, consulting engineer and likewise a code panel member; William Gaffney, Tacoma chief inspector and a code panel member. Following the Vancouver meeting presentation of the proposal was again made to the Electrical Section of NFPA at the annual convention of that organization in Los Angeles May 20.

If adopted, the proposal would affect the branch circuit wire sizes and service requirements in residential occupancies. The Spokane inspector insisted, however, that it would not affect that city's 200-amp expandable service entrance equipment requirements which would still provide raceway capacity for increased loading later on.



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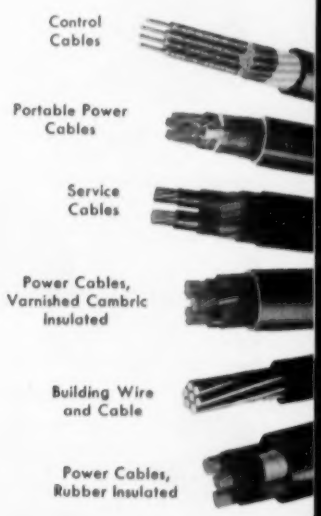

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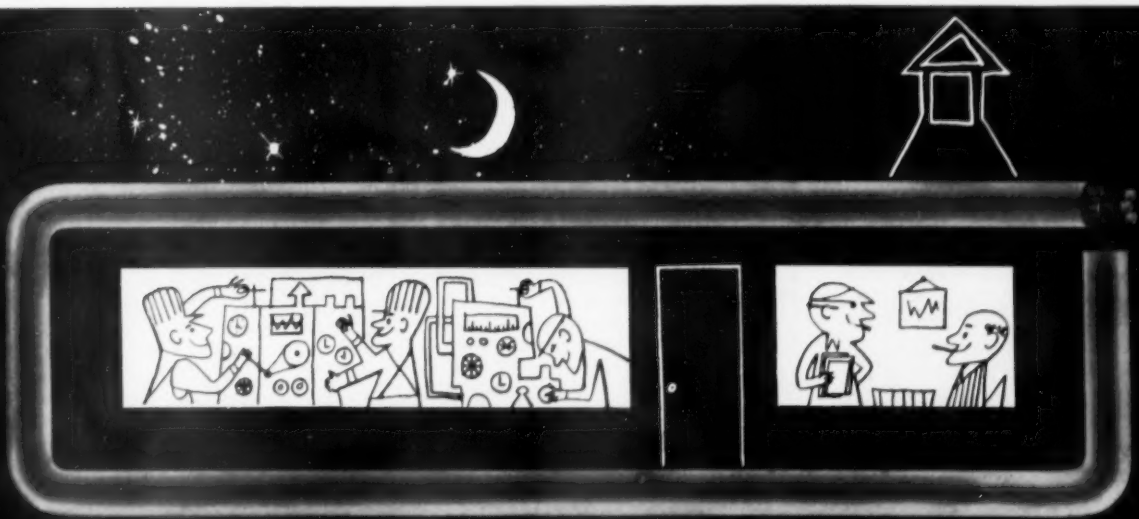

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ALBERT FRANK, Eastern Electric Co., Boston, and J. W. Werther, Werther Electrical Contracting Company, Inc., attended the District No. 1 conference at Manchester, Vt.

IES Regional Conferences

A new recommended standard for the lumber industry was given a prominent part in the Pacific Northwest Regional Conference of Illuminating Engineering Society held at Victoria, B. C. Prof. Dan Finch of the University of California reported the results of a study jointly sponsored by the IES, University of California, Redwood Lumber Industry and Pacific Gas and Electric Co. at the request of the lumber industry. The specific problem chosen was the lighting of what is called the green chain, where the green or freshly cut boards are inspected for flaws and graded according to quality. The work resulted in a recommended standard which will soon be published by the society. Following Finch's paper, D. C. Gordon of B. C. Electric Co., Vancouver, assembled a panel consisting of T. W. Beadle, Washington Water Power Co., Spokane; Professor Finch; W. S. Gordon, a consulting engineer in Tacoma; and Stickney Harris of B. C. Electric, Victoria, to discuss the entire problem of saw mill lighting.

This subject and school lighting provoked the most discussion from the floor. The school lighting topic was opened by Willard Allphin of Sylvania Electric Products, Salem, Mass., who urged that maintenance factors proposed in the IES standard be regarded as minimums instead of the average and that recommended standards call for 50 footcandles rather than 30 footcandles. This would require full sized electric lighting installation even when extra daylighting is provided and controlled.

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The meeting was addressed also by IES President Marshall Waterman of Westinghouse Lamp Division, Bloomfield; E. B. Karns, manager, Outdoor Lighting Sales, Westinghouse Lighting Division, Cleveland; Charles N. Clark, General Electric Co., Nela Park. The conference was presided over by Ken Reid, electrical engineer for the city of Victoria, who discussed the history of local street lighting practice. G. J. Roper was conference chairman.

South Pacific Regional Conference

Greeted by Otto K. Olesen, originator of the spectacular premier searchlight lighting, now Los Angeles postmaster, this conference at the Statler, Los Angeles, April 3 to 5, somewhat featured the spectacular in lighting. Olesen's successor, Bill Todt, described the spectacular lighting effects at the St. Louis Mid-American Jubilee last September, and Tom Warren of Ultra-Violet Products, San Gabriel, displayed spectacular black light effects.

The industrial lighting session likewise featured description of exceptionally high footcandle level industrial lighting jobs. Among these were the Metwood Manufacturing Corp., a precision tool plant having 200 footcandles in its shops and offices. R. J. Schoen, secretary-treasurer, reported on the improvements in conditions following this lighting. The audit taken showed rejects and reworks reduced 32%, lost time accidents were down 52% and employee turnover down 58%.

Similar experience was reported at the Helipot Corp. plant owned by Beckman Instruments, at Newport Beach. Making electronic components, W. M. Semple of that company said that a single reject on a product can cost several hundred dollars. Thus the 180-footcandle levels maintained throughout the plant are a necessity, and 400 footcandles are provided for the microscopes where precision work is done under a microscope. Monotony of a high level luminous ceiling installation of 150 footcandles was described by Robert L. Sawyier of Pacific Gas and Electric Co., Oakland, in telling of the Beckman Instrument Co. office job in Berkeley. He said the occupants felt the need of some contrast rather than the high level of intensity which made them seem to want to "turn on some lights."

Probably the most significant thing reported at the meeting was at a special breakfast at which

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members of the joint task committee of IES, AIA, and the National Council for Schoolhouse Construction, which had met just prior to the regional conference, reported agreement at last for revision of the recommended school lighting standards.

Some of the principal exponents of different viewpoints formed a panel under John Charlton of Toronto as chairman. On the panel were C. L. Crouch, IES technical director; Foster Sampson, consulting engineer, representing the architects; Charles Gibson, California Department of Schoolhouse Planning. Other members of the task committee, E.M. Strong; Carl Allen of GE; John Walsh, PG and E; and Willard Allphin of Sylvania, were also present. The most controversial issue of brightnesses to be permitted under the recommended practices seemed to have been resolved. The group also reported satisfactory control of outdoor brightness levels through windows of smoked glass which permitted the outside view for psychological effect but reduced the glare from all outdoor sources and surfaces to permitted ratios of contrast.

This conference was presided over by Carlton Thompson, San Diego Gas & Electric Co., regional vice-president, who announced that next year's conference would be held in San Diego. Host chapter chairman was Jake Hochenauer, Smoot-Holman Co., chairman of the Southern California Section. Bill Shalda, Shalda Manufacturing Co., was general chairman.

Intermountain Conference

As the location for the first Far Western installation of high-voltage, high-frequency lighting, the Albuquerque conference of the Intermountain Region naturally featured high-frequency lighting. Carl Albach, consulting engineer for the installation at the University of New Mexico gymnasium, likewise was conference co-chairman. Carl Allen of GE Lamp Division described the original installation at Union College gymnasium and told the basic reasons for selecting the frequency and voltage used there. A similar 400-cycle, 600-volt system is being used in the New Mexico gymnasium by Albach. Unfortunately the job was not far enough along for a field trip to the gymnasium but Albach described it in detail to the conference.

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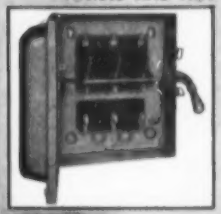

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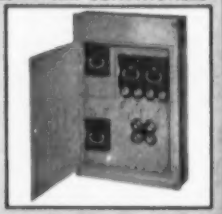

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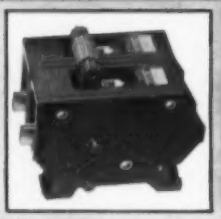

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IES PRESIDENT Marshall Waterman and Robert Uhl, chairman of New Mexico Chapter at IES Intermountain Regional Conference, Albuquerque, N. M.

ditioning in relation to lighting, was described frankly by Frank H. Bridgers, consulting engineer of Albuquerque, whose own building is a solar heating job. He described the activities of the air conditioning engineers and the illuminating engineers in pooling data to the end that better coordination of the two systems could be made.

A final discussion on lighting design viewed from various angles sparked the liveliest discussion period at the Albuquerque meeting. With F. A. Dunn, manager, GE Supply Co., Albuquerque, as the moderator, the panelists were Don P. Schlegel, assistant professor of architectural engineering at the University of New Mexico; J. Joseph Lopez, partner with Robert Uhl, consulting engineer; Lyle M. Bailey, vice-president, Albert Sechrist Co., Denver; and maintenance contractor Gerald Joseph of Lighting and Maintenance Co., Albuquerque. Schlegel presented the abstract design viewpoint of the architect and deplored the attempts by the lighting industry to conceal lighting equipment behind traditional forms or to make it appear to be something other than lighting equipment. Engineer Lopez discussed the difficulties of the consulting engineer trying to adapt existing equipment to the abstract design of the architect and still serve the function of good illumination. Bailey, as a fixture manufacturer, told of the difficulty in keeping up with fads in architectural design and still put out functionally efficient equipment. Dunn, as a supplier, told how his people are called upon for information and the responsibility for providing quality equipment. Joseph told all of them they should consider how equipment is to be maintained and relamped when making their design.

This conference was presided over by Jerry Whitnell, regional vice-president, Arizona Public Service Co., Phoenix.

Rocky Mountain Conference

Outdoor applications of lighting, not only for streets and highways but for advertising, floodlighting and other applications, was made the main purpose of a special combined meeting in Denver April 24. It was sponsored by the Rocky Mountain Section, Illuminating Engineering Society, in cooperation with the Rocky Mountain Electrical League which held its spring meeting the previous two days. Len Carlon, Sechrist Manufacturing Co., the IES section chairman, presided.

The program was conceived and arranged for by Hugh McCulloch of Independent Testing Laboratories, Boulder, Colo., who is chairman of the national IES progress committee. He arranged to have a meeting of the national committee at Boulder just following this meeting in order to bring the talent from that committee to Denver for the symposium on outdoor lighting.

Speakers included local people and the experts from the East. Among the local speakers were J. A. Setter, General Electric Co., Denver; McCulloch and other local members of IES. Others included: Stanley Starr, Revere Electric Co., who discussed trends in street lighting and gave the approaches to be used for selling a better proportion of the highway cost to street lighting.

Robert E. Faucett, General Electric Co., Andersonville, N. C., discussed trends in floodlighting. A. R. Jaeger, Corning Glass Works, described and exhibited various types of glassware suitable for outdoor applications. H. A. Williams of Rohm & Haas did the same in respect to plastic materials for outdoor lighting applications.

James Howenstein of Neon Prod-

AT IES MEETING in Denver are Lloyd Reed, vice chairman and Len Carlon, chairman, Rocky Mt. Section; and J. H. McCulloch, Independent Testing Laboratories and chairman of IES Progress Committee.

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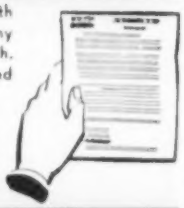

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ucts, Inc., Lima, Ohio, talked of the application of both lamps and materials in respect to the sign maker. He predicted whole building fronts made luminous in packaged units prewired and equipped at the factory and assembled on the job.

Eugene Beggs, Westinghouse Electric Corp., Lamp Division, discussed results of research on the effects of low temperatures on fluorescent lighting systems. With the new rapid-start and slimline lamps he assured the listeners the old problem will have been solved. E. A. Lindsay, General Electric Co., Nela Park, told and illustrated outdoor applications of the new light sources available for outdoor use. This included new mercury lamps, new incandescent and sealed beam types and the new power groove fluorescent sources.

President Marshall Waterman of IES flew in for the evening dinner, commending the group for initiative in developing programs of this character. The noon luncheon was provided comedy relief by William A. Cyr, Western consultant, Electrical Construction & Maintenance, who kidded the lighting profession with a talk "Still in the Dark—Some Research Projects Needed But Good."

Far West Chapters NECA Meet in Portland

Need for self training in management and for more training of apprentices to meet the electrical industry's growth challenge seemed to predominate in the program and discussions at the joint conference of three districts of National Electrical Contractors Assn. which met in Portland, Ore., May 20 to 22. It brought together about 150 officers and members from 19 chapters of District 6, 8 and 9 from the states of Oregon, Washington, Idaho, Montana, Utah, Colorado, Wyoming, California, Nevada and Alaska. It was presided over in turn by the three district vice-presidents W. R. Grasle, of Portland, District 6; Phil Robins, former vice-president and acting for District 8, Salt Lake City; and R. Goold, Stockton, for District 9. The host chapter was the Oregon-Columbia under Laurence Rodgers & Staff.

Better management, policy and practices to bring success to contracting was emphasized by A. H. Gudie, president, Biddle Trade Publishing Co., Los Angeles, form-

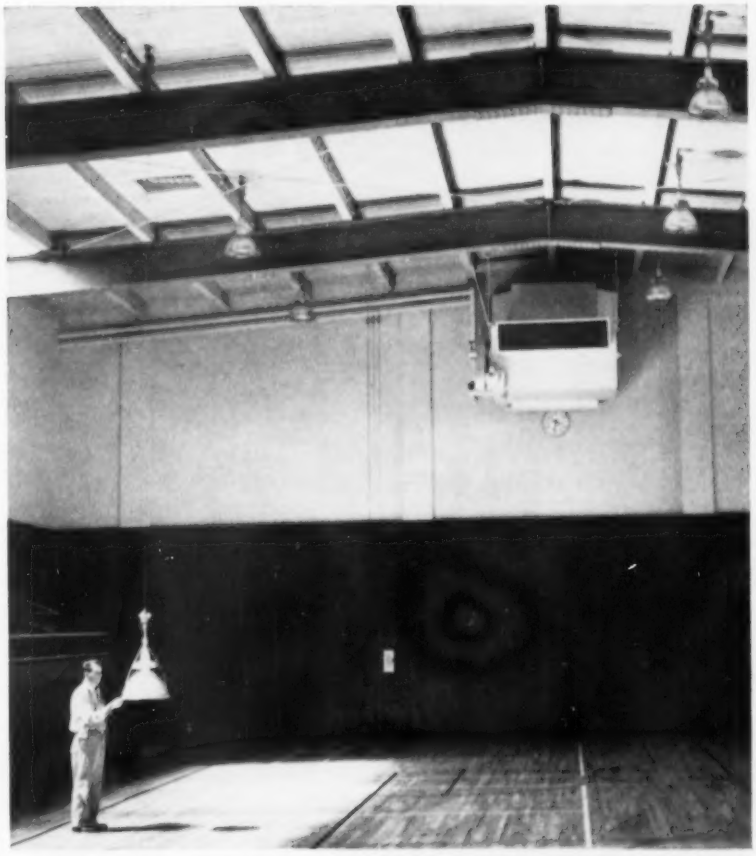
THREE VICE-PRESIDENTS for the three districts that jointly met for the annual NECA spring conference at Portland, Ore. Phil Robbins, of Central Electric Co., Salt Lake City, former District 8 vice-president who acted for Ralph Johnson of Denver while the latter was in Europe; W. R. Grasle of Portland, vice-president of District 6; and R. Goold, of Stockton, Calif., vice-president of the recently formed District 9.

erly a contractor himself. Many of the problems of the business at present, he said, were because there was more business available to contractors than they have facilities, personnel and finances to perform efficiently. "If you had to limit your operations to the amount justified by the capital you have invested in your own business, by your physical facilities or by the personnel of your regular organization you would automatically recognize that the reduced volume would have to make all of your profit," he said. With potential construction business so tremendous he urged, "Because your business will be bigger your customers will expect more business-like methods."

Opportunities in the Housepower program of home modernization were stressed by William Tait of Portland General Electric Co. He pointed out, among other things, that today's middle income group has six times more purchasing power than the same group in 1940. It is in this market that the home modernization opportunity lies.

The various business and training services of NECA provided through the Research & Education Department were explained by E. R. Cornish, director, and their application to the individual contractor's business was shown. The NECA labor manual Section H has been reissued to aid in estimating residential modernization work in line with the Housepower program.

Other phases of the program covered a Line Constructors' session in which a new training program for line apprentices was described. Complete text for such a course has



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It's no secret! Servicing *fixed position* high-bay luminaires is difficult, hazardous and costly. Relamping one fixture mounted 20 feet or more above the floor normally involves erecting scaffolds or ladders . . . two or three men . . . about one hour's time. And because the fixture is "hot", one man must be a skilled electrician.

BUT . . . when high-bay lights are equipped with THOMPSON HANGERS, the job is fast, safe, easy. One unskilled man can relamp and clean a light . . . whenever necessary . . . in an average of 5 minutes! All work is accomplished at floor level with a "dead" fixture. No climbing hazards, electrical dangers or assistance are necessary for fast efficient servicing.

No matter how you figure it, if you want long range economy and peak lighting efficiency . . . THOMPSON HANGERS are your best buy.

FOR DETAILS, WRITE TODAY FOR BROCHURE TH-57.

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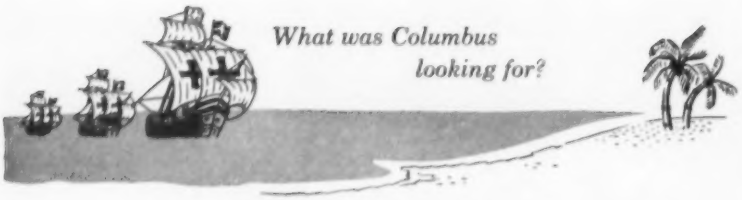

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CONDUIT FITTINGS

For years the name "Conduit of Columbus" has been the standard of leadership in conduit fittings. To positively identify this quality, specify the brand name "Columbus" conduit fittings. Ask for them by name.

CONDUIT PIPE PRODUCTS CO., COLUMBUS, OHIO

SOLD ONLY THROUGH RECOGNIZED WHOLESALERS

BROOK MOTORS

Pump Motor

Totally enclosed non-ventilated

Single-Phase

Open drip-proof

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. . . because they're built better to last longer. Constructed to meet or surpass NEMA standards. Specially designed to resist moisture, oil, dust, heat. Try a Brook on your next replacement. Sizes from 1 h.p. to 600 h.p. Send for literature.

FAST DELIVERY OF ALL POPULAR MODELS!

Brook A.C. Motors are available from warehouse at Chicago, Dallas, Jersey City, Los Angeles, Memphis, St. Paul, Salt Lake City, San Francisco, Atlanta, Seattle, Tampa, and other major distributing points.

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HOSTS for the three-district NECA spring conference in Portland were Larry Rodgers, manager of the Oregon-Columbia Chapter as well as the Northwest Line Constructors Chapter, and Wes Grasle, W. R. Grasle Co., Portland, NECA vice-president for District 6.

been developed in the Oregon area as a task force of the joint apprenticeship national committees.

Legal booby traps, most of them arising over payment of money when it is due, were discussed by William Lubersky, attorney for the Oregon-Columbia Chapter. He advised keeping complete records and letters on all transactions, especially on change orders and time delays.

Paul Geary, executive vice-president, discussed other phases of NECA operation, particularly labor relations and membership. He likewise answered questions regarding the Federal Construction Practice Act which the meeting later endorsed by resolution. Another resolution passed supported private development of the power facilities on the Trinity River in California. A third resolution called upon private power companies to adopt a contract policy to submit to bid any proposed construction that lends itself to competitive bidding.

The next such tri-district annual meeting will probably be held in California in May of 1958.

Closed-Circuit TV In School System

Television has "a tremendous potential in improving the very basis of American education," the recent Summer General Meeting of the American Institute of Electrical Engineers was told in a session describing a closed circuit TV installation in the school system at Hagerstown, Md.

The TV system in eight schools at Hagerstown, is used by 6,000 pupils and eventually will encom-

pass all 48 schools in Washington County, Md., which has 18,000 pupils, Max H. Kraus, of Jerrold Electronics Corporation, Philadelphia, Pa., spoke of one of four papers describing the TV system.

"The television installation at Hagerstown", said Mr. Kraus, is "providing low-cost, reliable television to some 6,000 pupils, with planned expansion to over 18,000 students. Already the overall program has proven itself to have a tremendous potential in improving the very basis of American education."

In another paper, "Pioneering in Televised Education," John R. Brugger, a member of the Hagerstown Board of Education, said the TV system by Sept. 1957 would include addition of 6,000 sq ft of operating space, in addition to the 5,000 already in use; a total of five live video studios; six operating channels, five of which are for live use; 21 elementary schools and two high schools receiving an aggregate of 27 lessons daily on approximately 510 television sets; participation of approximately 12,000 students in direct and supplemental instruction programs.

The 1957-58 program also includes these possibilities, he said: Erection of a low power ultra high frequency transmitter for telecasting instructional programs to the community at high school and junior college level; installation of microwave equipment for two-way telecasting to a teachers college in a nearby community; equipping a mobile unit for local special event coverage.

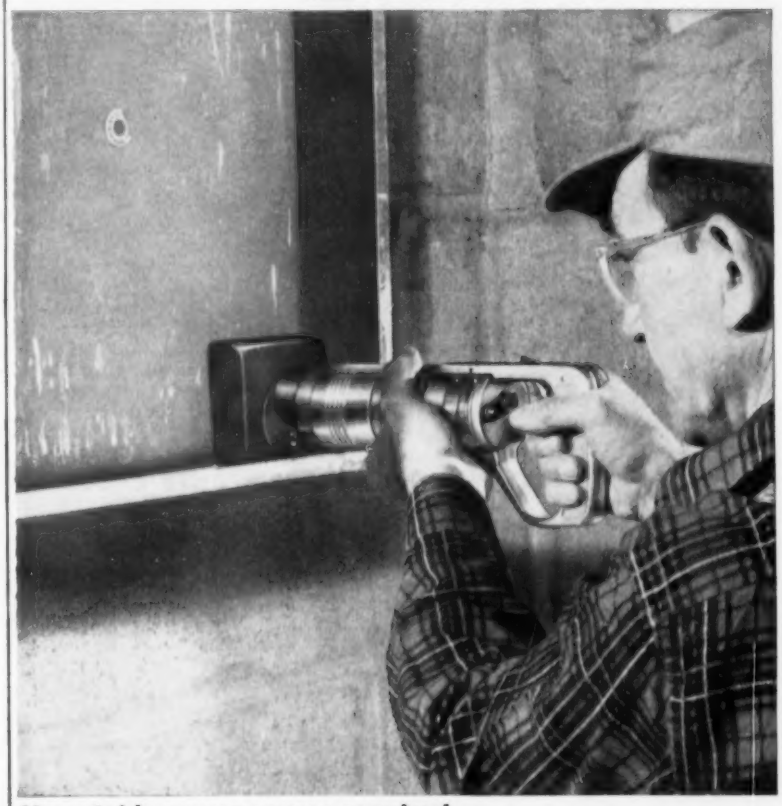
The opening of the Sept. 1958 school term will conclude the technical expansion of the five year project, he said. Anticipated additional equipment will include a live color studio equipped with dual camera chains; approximately 60 color receivers; 25 additional school distribution systems for the balance of schools in Washington county, and addition of 400 television sets.

High Frequency Electric Power

A "quite different" future for the use of high frequency electric power was predicted at the recent Summer General Meeting of the American Institute of Electrical Engineers in Montreal, Quebec, Canada.

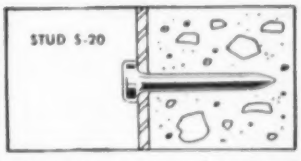
"The outlook in the future for the generating, distribution and

Just one of *101* Stud Driver uses!



No outside power source required—

Anchor switch boxes to concrete or cinder block in seconds with the Remington Stud Driver



Heavy boxes are securely anchored with a Remington S-20 Stud and 22 caliber Power Load . . . no bolts or washers needed. Special guards adapt the Stud Driver for fastening inside smaller electrical boxes of every type and size.

It's easy to install outlet, control and utility boxes when you're using the compact, cartridge-powered Stud Driver. Just a squeeze of the trigger drives a metal fastening stud into concrete or steel . . . without pre-drilling! You can set up to *six* ¼" or ⅜" diameter studs a minute—change barrel size in just 90 seconds, *right on the job.* There are more than 40 Remington Studs to choose from, plus 22 and 32 caliber Power Loads scientifically graded to do the work.

SAVE TIME AND EFFORT on your construction jobs. The coupon brings a valuable free booklet that shows how and where to use the Stud Driver.

Remington

DUPONT

STUD DRIVER

Industrial Sales Div., Dept. ECM-7
Remington Arms Company, Inc.
Bridgeport 2, Conn.

Please send me your free booklet which shows how I can speed the job and save with the Stud Driver.

*Name*_____ *Position*_____

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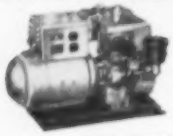
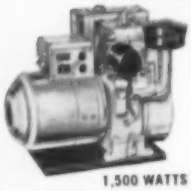
WHEN POWER FAILS—

YOUR WINDPOWER EMERGENCY PLANT Takes Over Immediately

WINPOWER Electric Plants



800 WATTS AC



1,500 WATTS AC

Power failures occur when you least expect them. When a WINPOWER Plant is on the job, it takes over *instantly* no matter what the emergency. No interruption to lighting, heating, refrigeration, elevator operation or other electrical services.

The new 1957 models are available in all voltages and phases up to 100 KW —AC or DC. More than thirty years of experience guarantees top performance and long life. These plants powered by world famous engines are priced to beat all competition. Write for *proof*. No cost. No obligation.

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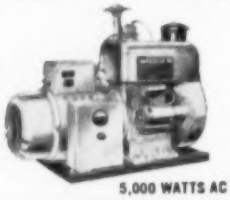
CONTRACTORS
Portable units also available for operating contractors power tools.



5,000 WATTS AC

10,000 WATTS AC

AMERICA'S FINEST ALL-PURPOSE TOOL POUCH

ELECTRICIAN'S PAL

ROOMY — FUNCTIONAL EXPERTLY CUSTOM MADE

Designed by Electricians, for Electricians, with the Right Pockets in the Right Place, in the Right Size, and All Generously Pouched to Receive Tools Instantly.

Used widely by electricians, maintenance men, service men, mechanics and radio and TV men. A kit that literally saves hours of on-the-job time, doubles tool capacity, yet is compact and functional, and gives organized finger-tip control of tools. CONSTRUCTED TO LAST FOR YEARS.

BEAUTIFULLY MADE IN 6 TO 8 OZ. EYE-APPEALING BUCKSKIN TAN SMOOTH TOP GRAIN LEATHER.

CHECK THESE BIG FEATURES

Wide tunnel loop for quick on-and-off. Kit slips around to the right spot.

Double 7" deep screwdriver slot that holds 2 of them upright and handy.

4½" by 7" deep inside roomy pouched pocket for larger pliers and bigger tools.

Roomy 2½" x 5½" deep front side-cutter or plier pocket. Pocket is generously flared and pouched.

Chain friction tape holder with metal "T" hinged bar. Keeps tape at the finger tips.

Capped chrome rivets that secure stress points. Makes bottom of pockets puncture-proof.

Deep narrow slot for electrician's long slender screwdriver. Stays upright, handy.

3½" by 7" roomy larger tool pocket. Leather divider separates center pocket section.

Leather bound edge for long wear.

Fastener for switching tape chain to left side of kit.

3" deep open bottom tapered side loop for push drill, big screwdrivers, hammer, etc.

3¼" by 5¼" deep flared and pouched front small tool pocket.

Box rule 4" by 5½" front pocket pouched to hold 6' folded rule or large pliers.

Over-All Size 8" wide by 10" long.

Guaranteed to please or money back

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HAROLD A. WEBSTER, president, T. Frederick Jackson, Inc., Long Island City and D. J. Crimmins, manager New York City No. 1 Chapter, NECA, enjoyed the many activities at Equinox House, while attending the District No. 1 meeting.

use of high frequency power will be quite different from that experienced in the last 10 or 15 years," Vernon C. Geckler, of General Motors Corp., Bristol, Conn., said in a paper on industrial application of high frequency power.

"With the exception of special applications where there is a large fixed high frequency requirement, automation and integration lines will dictate the use of smaller size generating units located and sized specifically for a particular production line. Generating units used for these integrated lines will not be direct connected units but V-Belt driven units on which the belts may be changed to vary the generator speed to gain a different frequency or variable speed drives will be used to change frequency. This means a greater number of units to maintain but the end results of integration will warrant the application of these small units. In the not too distant future it is very possible that there will be developed an electronic unit which will be sufficiently small in size as to be installed on any one machine tool and will have the ability to vary its frequency within the range requirements of this machine."

High frequency, he said, has and will have application for internal grinding, portable tools for high production lines, woodworking machines and commercial and industrial lighting. The last two would include auditoriums, gymnasiums, large store areas and large manufacturing floors.

The use of high frequency, incidentally, is not new, but has been used satisfactorily to a limited de-

gree for 50 years, although at that time little was known about its application. General Electric Company developed the first large industrial application for high frequency power in 1904, utilizing 150 cycles, at Bristol, Conn.

Scholarships Awarded By Joint Industry Board

The Joint Industry Board of the Electrical Industry of New York presented college scholarships to 31 high school graduates at a breakfast in the Waldorf-Astoria on June 22. Each scholarship entitles the recipient to six years of study at Barnard College, Columbia University, Fordham University, Manhattan College, or New York University or at an approved medical or dental school. Each scholarship is worth up to $5,280.

The scholarship program, now in its ninth year, is sponsored by New York electrical contractors and Local 3 of the International Brotherhood of Electrical Workers. Sons and daughters of members of the electrical industry are eligible. This year there were 110 contestants for the awards.

Approximately 1,000 attended the breakfast at which A. Lincoln Bush, chairman of the Pension Committee of the Joint Industry Board presided. Governor Harriman was one of the speakers.

HOW TO BE A HAPPY TAXPAYER, the subject of a talk by Bob Swados (second from left), of Cohen, Swados, Wright & Hanifin, attorneys from Niagara Falls, prompted this post-forum conversational continuation with L. A. Nelson, M. H. Salmon Electric, Syracuse, N. Y.; convention co-chairman Glen Frosdick, Dynamo & Moter Exchange, Buffalo, and Glenn Wardell, convention program chairman, Wardell Thurston Electric, Buffalo.

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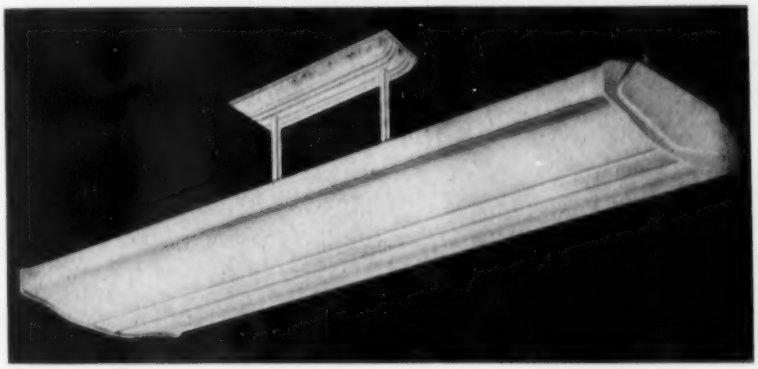
MORE ***TROUBLE FREE*** *LIGHT YEARS WITH* ***MITCHELL LIGHTING***



lume-glow

Distinguished commercial interiors deserve Mitchell's "Lume-Glow" luminaires. "Lume-Glow" fixtures with the "Evenglo" diffusing shield combine abundant light output with low surface brightness . . . providing comfortable reflected semi-indirect lighting. Streamlined in styling . . . "Lume-Glow" luminaires are manufactured in Mitchell's modern manufacturing facilities to Mitchell's recognized high standards of quality and dependability. Write for complete specifications.

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"HANG ON . . . I'LL CHECK THE

Maybe you've known his voice for years—and never met him.

To his customers he's often the most important man in the electrical distributor's whole operation—including the boss.

Telephone salesman, he's usually called, but that doesn't begin to cover what he does in an average workday. (Note the head-set: he needs both hands and could use a couple of spares.)

He'll take your order on the phone . . . offer guidance on buying at the fairest possible price. . . . More than that, he'll make sure the order gets on the truck, and delivered when you want it.

He keeps an alert eye on the stock shelves so he can tell you, "Yes, we have it," or, "We'll track it down for you in a hurry."

He's a master librarian who'll try to answer just about any product question you can ask, from his rows of catalogs.

Expediter . . . trouble-shooter . . . hub of communications, his *main* function is service . . . to help you save time and money when you're buying electrical products.

He's one more excellent reason it pays *you* to do business with your electrical distributor.

ELECTRICAL Wholesaling
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The industry's sales and management magazine

ABP
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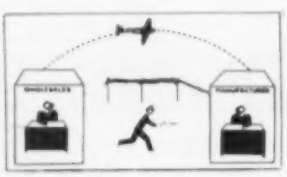
Your electrical distributor offers you these services:

His hundreds of purchase orders keep a flow of thousands of different products rolling from manufacturers into his warehouse the year around.

By airmail, telegraph, telephone, the distributor keeps in touch with the many manufacturers whose lines he stocks, to expedite his shipments to you.



Regardless of how the distant manufacturer ultimately will compensate him, the distributor adjusts claims, returns goods, issues credits.

He trains and maintains a staff of salesmen who know the products required by the industry — where, how and when they are used.

PRICE SHEET FOR YOU..."

He assembles into single shipments the products of factories near and far, in sizes, types, and quantities the user needs.

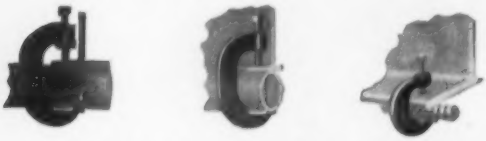
He maintains a warehouse from which you receive swift, economical delivery of a vast variety of products, plus staggered storing for specific jobs, as needed.

His counter and telephone service require trained men who know the hundreds of products handled, their uses, codes and ruling in effect locally.

Carry WATER, GAS AIR LINES, CABLE at any angle to beams

with "EFFICIENCY" CONDUIT HANGER "TYPE F"

On open steel construction. Efficiency "Type F" conduit Hangers are your best choice for carrying ½" to 2½" pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cables suspended dead center, permitting it to be carried securely at any angle to the beam.
Write today for Catalog 38-A.



"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

Efficiency ELECTRIC AND MANUFACTURING CO.
MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT AND WIRE CABLE SUSPENSION
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WALK — DON'T RUN TO THE NEAREST TELEPHONE . . . The WHEELOCK CODE CALL permits instant communication by means of audible signals, with personnel away from desks or with employees who normally cannot be reached directly by telephone. The busy switchboard operator just presses the button; a numerical *code call* sounds off throughout the building and the person being paged responds via the nearest telephone. Easy to install with any desired combination of chimes, bells, horns and other signalling devices.

just press the button!

Write for Bulletin 48-3
Engineering Representatives in Principal Cities

Digital Engineering & Mfg. Co. has changed its name to Wheelock SIGNALS INC
CODE CALL
LONG BRANCH, N.J.

J. M. Harrington Named Exec. Vice President of NISA

Joseph M. Harrington has been appointed executive vice president of the National Industrial Service Association. He succeeds Fred B. Wipperman, who asked to be relieved of active management of NISA. He has agreed to stay on as executive consultant.

Mr. Harrington, who joined the NISA executive staff last November, was previously secretary-manager of the Iowa Chapter of the National Electrical Contractors Association and an attorney for the Manufacturing Chemists Association. A native of Keokuk, Iowa, he is a graduate of Iowa and George Washington Universities.

Mr. Harrington has organized three new regional groups, the Rocky Mountain, Heart of America and Connecticut Chapters of NISA, since joining the NISA staff, bringing the total number of local and regional chapters in the association to 33.

C. F. Zweifel Named Chairman of Board

Charles F. Zweifel, was elected Chairman of the Board of Charles F. Zweifel & Co., electrical contractors of New York City, on June 10. At the same meeting, Charles F. Zweifel, Jr. was elected president, and Harold P. Reeder, vice president of the company.

Mr. Zweifel has been identified with the electrical industry for the past 55 years and president of Charles F. Zweifel & Co. for the past 23 years.

Building Managers Meet in New York

At the 50th annual meeting of the National Association of Building Owners and Managers, held June 23-27 in New York City's Waldorf Astoria Hotel, more than 1500 delegates attended a 4-day succession of seminars, forums, general sessions and luncheon round-table "workshop" discussions.

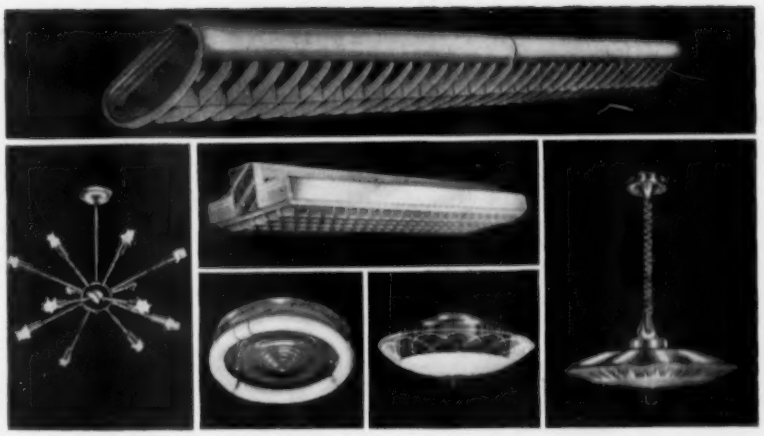
In one of these round-table workshops, a seven-man panel analyzed and suggested solutions to numerous operational and maintenance problems related to lighting, air conditioning, distribution and control, electric heating, rewiring and modernization.

Moderating the panel was Arthur L. Benjamin, Cincinnati Gas and Electric, who expressed the opinion that modern commercial structures today should provide from 12 to 15 watts per sq ft of floor area (with spare capacity to raise this average to 20 w/sf) to adequately serve present needs and to provide for expected tenant demands in the near future.

On the subject of how to provide high order of electrical service, he discussed the advantages of busduct risers, cellular floors, underfloor raceways, new thermoplastic-insulated wires, changing systems from 3- to 4-wires, using interlocked armor cables, using corners of elevator shafts to contain additional risers, installing auxiliary busduct risers on the outside of buildings to reach upper floors, installing automatic operatorless elevators to speed service and reduce payroll overhead, installing resistance heating to solve local problems, and investigating various applications of heat pumps.

In following discussions by R. J. Tennant of Pittsburgh, Ray H. Hartung of Cincinnati, James Lewis of Detroit, C. W. Tuttle of New York, and Kenneth R. Jensen of Minneapolis, additional helpful suggestions were offered pertaining to the use of high output and power-groove fluorescent lamps, the importance of good design and installation techniques to obtain good quality illumination as well as high footcandle levels, and the advantages of 480/277-volt distribution systems.

Also of interest to electrically-minded delegates was an exhibit by electrical contractor L. K. Comstock & Co., whose presentation included a silhouette skyline of New York City.



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buy quality lighting fixtures direct from factory

You can make more profit on lighting fixtures with the 'Site Saver' line. Sold direct, the low prices of these fixtures enables you to beat local and mail order competition...and still make a longer profit.

All fixtures absolutely guaranteed to meet with your approval. We certify highest quality and finest workmanship because . . . we make every item in the line . . . from glass bending and decorating to metal fabrication and finishing.

Here's the largest, most complete selection of fluorescent and incandescent fixtures offered by one manufacturer. Buying from one source saves you time and trouble. And you increase profits with 'Site Saver' lighting fixtures.

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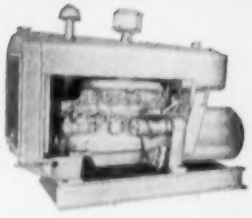
UNIVERSAL ELECTRIC POWER AND LIGHT PLANTS

New, low-cost lightweight, air-cooled 3500 watt model.

New popular diesel model has 25,000 watt capacity.



New models . . . both gasoline and *diesel* series . . . fastest deliveries . . . sure to please prices—that sums up Universal Electric Power and Light Plants—the fastest growing line today!
Whatever you want in the broad 250 watt to 35 kw range, Universal has it. Models for emergency, intermittent or constant service—anywhere. Air-cooled types, water-cooled multi-cylinder models. All controls. All offering definite weight- and space-saving advantages. Get all the facts!

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Send me complete illustrated electric power and light plant literature and prices.

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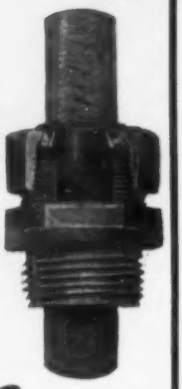
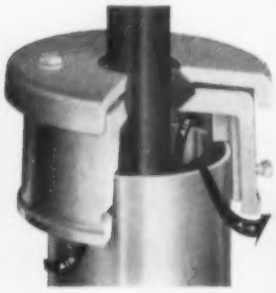
entrance cable fittings for 100-150-200 amp SERVICE



M&W

WATERTIGHT CONNECTORS 1", 1¼", 1½" and 2" Hub. ENTRANCE CABLE HEADS for 3-No. 3 to 3-No. 4/0. ENTRANCE CABLE STRAPS for 3-No. 2 to 3-No. 4/0. NON-WATERTIGHT CONNECTORS for 3-No. 2 to 3-No. 4/0. Just drop us a line on your company letterhead for latest, detailed catalog.

M&W Electrical Fittings
The M. & W. ELECTRIC MFG. CO., Inc.
EAST PALESTINE, OHIO

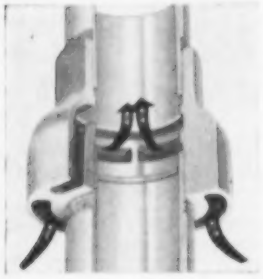


less HEAT more LOAD

FOR CABLE IN CONDUIT...WITH

PLM

CONDUIT VENTILATING CABLE SUPPORTS



Type BCV Conduit Ventilator provides air intake at base of conduit riser. May also be used at base of vertical splice between cable in conduit and armored cable, with PLM Splice Kit.

● Don't let bottled-up heat limit the load capacity and service life of cable in conduit! PLM Conduit Ventilating Cable Supports provide cooling air circulation . . . permit heated air to escape from cable risers in conduit where heat tends to build up. Watertight seal keeps water out.

Ventilating supports for top of riser supplied in types for new or existing installations, with or without flanges to support potheads. Write for full details, as well as information on PLM armored cable fittings, terminating and splicing kits, contained in PLM Catalog 301.

PLM PRODUCTS, INC. • 3875 West 150th Street • Cleveland 11, Ohio
WIRE AND CABLE FITTINGS AND ACCESSORIES

NISA News

The last exhibit had hardly been packed at the NISA Buffalo Convention in May before NISA's new executive vice-president Joseph M. Harrington and his staff began planning for the association's 25th Jubilee "Celebration", as the 1958 convention will be called. The event is scheduled for May 11-15 at the Hotel Roosevelt in New Orleans.

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Former executive vice-president Fred B. Wipperman, who is now serving NISA as a consultant, is a member of a joint NISA-NEMA committee which met last month to explore the possibilities of a project to determine the size of the motor repair market. Joseph Harrington; former NISA national president Charles J. Covington; NEMA's B. L. Britt, of Wagner Electric; and V. M. Nesti, NEMA chief statistician, are other members.

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R. C. Swartz, vice-president and general manager of Peninsular Armature Works, Miami, Fla., says that plans are under way "for a real open house reception" at his plant when NISA's Southeastern Chapter convenes at the Fontainbleu Hotel in Miami Beach this October.

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Mid-South Chapter met June 15 at St. Francis Hotel Courts in Mobile, Ala. One of the speakers was George A. Treiber of John C. Dolph Co., Monmouth Junction, N. J., varnish manufacturers. His topic: epoxy resins for compounding electrical equipment. Treiber

JUDGING the NISA national shop ideas contest, the results of which were announced at the recent Buffalo convention: (l-r) Alex Shovan of Industrial Electric Service, Hawthorne, N. J., committee chairman; Edwin E. Kolhonen, Peabody Electric Motor Service, Peabody, Mass.; Frank W. Ross, Ross Electric Motor Shop, Fairmont, Minn.; and Tom Paul of Paul Electric Co., Sioux City, Iowa. Judging took place at Shovan's shop.

DURING VISIT of Los Angeles Chapter of NISA to Littlejohn-Reuland Corp., Los Angeles. (L-r) Russell Lockard of Lockard Motor & Pump Co., Huntington Park, Calif.; George Larsen of Larsen-Hogue Electric Co., Los Angeles; Michael J. Kovall of Kovall Electric Motor Works, Hollywood; and Joseph Walta of Littlejohn-Reuland. Lockard and Larsen are the outgoing president and secretary-treasurer, respectively, of the chapter; Kovall and Walta are the incoming officers, Kovall being the new president.

treated a small stator at Russell Electric Co.'s shop during the chapter's tour of the city's service shops.

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Bill Hogue and George Larsen, of Larsen & Hogue Electric Co., Los Angeles, made reports of the Buffalo convention when they returned to their chapter. Los Angeles Chapter met June 11 at Michael's Restaurant. Several films—on Los Angeles, safety, discipline—were shown.

• • • •

NISA's 1956 sales survey showed no appreciable change in profits before income taxes. The 1956 figure was 6.14%, up only 3/100's of a percentage point over 1955, which was the lowest in five years.

About 75 shops participated in survey. E. M. Cook, W. M. Hogue, Walter Leirer and Howard Lilly were members of the survey committee which was chaired by Selden High.

• • • •

June 14 was Al Elson Day, the New England Chapter honoring the new NISA national president with a dinner at Johnson's Hummocks Grill in Providence. The meeting began with tours in nearby Pawtucket, R. I. where the Elson shop —New England Machine & Electric

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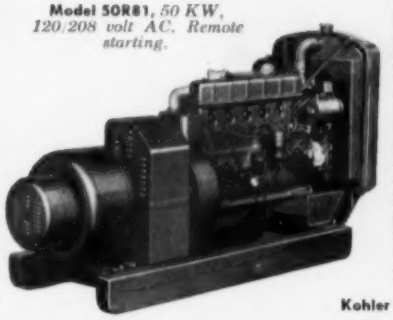

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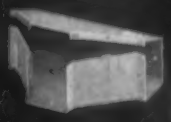
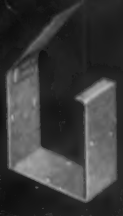


Flangeless hinged-cover lay-in T-Fitting Pull Box.



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AT THE NEW YORK Metropolitan Chapter of NISA, Charles J. Covington, (left) greets William Kauppert, General Electric Specialty Co., Hollis, N. Y. Covington's firm is Dowzer Electric Machinery Works, Mt. Vernon, Illinois.

Co.—is located. Shops toured included Electric Maintenance & Engineering Works in Woonsocket; Pawtucket Electric & Supply and New England Machine & Electric in Pawtucket; J&H Electric Co., Schmidt Electric Co. and Walco Electric Products Co. in Providence. A buffet lunch was served at the Elson firm.

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Great Lakes Chapter met April 15 at McNaughton-McKay Electric Co. to hear E. H. Olson, assistant technical director of Anaconda Wire & Cable Co., Muskegon, Mich., talk on "Magnet Wire—Present and Future."

• • • •

Central District Chapter (Chicago) of NISA met May 7 at Graemere Hotel to hear L. B. Ronk, president, System Analyzer Corp., Nokomis, Ill. describe some of his company's products: Add-a-phase,

AT MEETING of NISA's North Central Chapter in St. Paul, Minn.: (l-r) Warren Mielke of Mielke Electric Works, Inc., Duluth, Minnesota, and Ross Dunham of Boustead Electric Co., Minneapolis, Minnesota.

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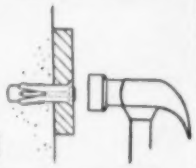

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DEALERS: Novasep Anchors are available in bulk, or in individual packs of four anchors with counter display. For full data, write to Department N-7.

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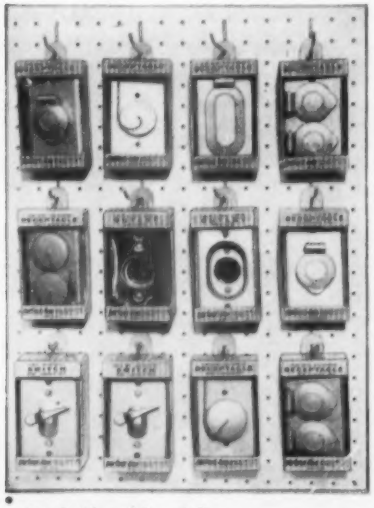

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Phase Shifter, and Power Twin, devices for operating ac motors from single-phase supplies.

• • • •

New Orleans Chapter, host to the coming NISA Jubilee Celebration, met April 23 at Irwin's Restaurant. S. J. Stewart, W. A. Dreis, M. Garcia, A. J. Dollocchio, Barney Oufnac, Ed Richardson, L. Bastian and H. Davis attended.

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Committees for the coming year have been appointed by New York Metropolitan Chapter's president, William Kauppert: By-laws, John Ryan; membership, Ralph Mollet; program, Dick Wheeler; news bulletin-publicity, Dan Chiswick; convention and attendance, Edward Everts; award, Ralph Mollet; surplus wire, John Ryan; trouble clinic, Walter Leirer; "Ladies Night", Alex Shovan.

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The June dinner dance of the Quaker City Chapter was held June 21 at Sandy Run Country Club, Oreland, Pa. A golf tournament was held in the afternoon. NISA director Joe Wagner was chairman.

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Bill Williams of Swanson-Nunn Electric Co. is the new president of King Coal Chapter; vice-president is John Eggiman of Cape Armature Works; secretary-treasurer, Ralph Fuhrmann.

• • • •

The new Rocky Mountain Chapter meets Sept. 20-21 in Durango, Colo. Malcolm Logan is in charge of arrangements.

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Harry M. Rezer was named president of Electric Maintenance Equipment Co., Philadelphia, replacing the late W. J. Sommer.

JACK PERSSON, Electric Apparatus and Repair Company, Philadelphia, discussed features of his authorized-service-for-motor-manufacturers department with Dick Giles, a fellow member with similar interests from the Missouri Electric Works, Cape Girardeau, Mo., when they met at recent convention in Buffalo.

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DATES AHEAD

Western Electronic Show and Convention—Cow Palace, San Francisco, Calif., August 20-23.

American Institute of Electrical Engineers—Pacific general meeting, Pasco, Wash., August 28-30; Fall general meeting, Chicago, Ill., October 7-11.

National Association of Electrical Distributors—Western region annual convention, Hotel del Coronado, Calif., September 8-11.

International Association of Electrical Inspectors — Northwest Section, Spokane, Wash., September 9-11; **Western Section,** Sherman Hotel, Chicago, Ill., September 23-25; **Canadian Section,** Park Plaza Hotel, Toronto, Ont., October 4-5; **Eastern Section,** Rochester, N. Y., October 7-9; **Southern Section,** Dinkler-Plaza Hotel, Atlanta, Ga., October 14-16; **Southwestern Section,** Westward Ho Hotel, Phoenix, Ariz., November 4-6.

Illuminating Engineering Society — 51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Instrument Society of America—12th annual instrument-automational conference and exhibit, Cleveland Auditorium, Cleveland, Ohio, September 9-13.

Technical Conference on Electrical Maintenance—King Edward Hotel, Toronto, Ont., Canada, September 27-28.

International Association of Electrical Leagues—Annual meeting, Sheraton-Sinton Hotel, Cincinnati, Ohio, October 2-5.

Electrical Progress Show — Commercial Museum, Philadelphia, Pa., October 7-9.

National Electronic Conference—Hotel Sherman, Chicago, Ill., October 7-9.

Canadian Electrical Manufacturers Assn.—13th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., Can., October 9-11.

Rocky Mountain Electrical League—Annual convention, Broadmoor Hotel, Colorado Springs, Colo., October 13-17.

Florida Association of Electrical Contractors — Annual Convention and Electrical Trade Show, Soreno Hotel, St. Petersburg, Fla., October 16-19.

National Electrical Manufacturers Assn. — Annual convention, Traymore Hotel, Atlantic City, N. J., November 11-15.

National Electrical Contractors Association—Convention and Exposition, Netherland Plaza and Sheraton Plaza Hotels, Cincinnati, Ohio, November 11-16.

American Standards Assn.—Eighth National Conference on Standards, St. Francis Hotel, San Francisco, Calif., November 13-15.

Air-Conditioning and Refrigeration Industry—10th Exposition, International Amphitheatre, Chicago, Ill., November 18-21.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 20-24, 1958.

National Rural Electric Cooperative Assn.—Annual meeting, Dallas, Texas, February 2-6.

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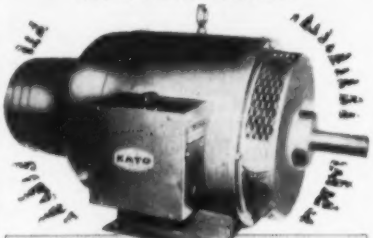

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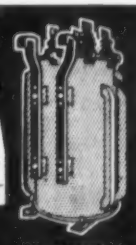

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WEIGHT	46 LBS.	100 LBS.

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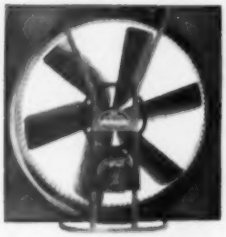

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WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: Is it Constitutional to revoke a master electrician's license because he engages in an unrelated business?

The necessity of eating posed a serious problem to Horace, a licensed master electrician for over 28 years. Unable to find employment, he had to choose between that vital consumption and his electrical function. Naturally, he chose eating.

Going into a retail business, Horace was shocked, one day, to learn that the commissioner of the Department of Water Supply, Gas and Electricity had recalled his master's license.

"Under a City law," it was pointed out to him, "a master electrician's license may be revoked when he is principally engaged in a business other than that of being a master electrician."

"You're primarily in the food business now," Horace was told. "That's why your license was cancelled."

Highly indignant, Horace made a bee-line to court where he demanded that his license be restored to him.

"That City law is absolutely unconstitutional," he insisted. "It deprives a person of the right to work as a master electrician simply because he can't earn sufficient money at it to get along. It's not fair! I'm a top-notch electrician and need the license to enable me to supplement my income."

THIS WAS THE DECISION: The Court ruled against Horace. It said a master electrician engaged in the electrical business is less likely to "cut corners in order to save time and money"—for fear of losing his license—than the holder of such a license who, principally engaged in another business, is not dependent upon it. Therefore, concluded the court, in view of the dangerous nature of electricity, the City law is reasonable. It affords a certain degree of protection to residents.

(Based upon a 1956 New York Decision. State laws vary. For personal guidance, see your local attorney.)

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MALLEABLE IRON PULLING ELBOW

PRECISION MACHINED FOR PERFECT FIT

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- no obstructions inside, all smooth surfaces
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- sizes marked on both covers and elbows

SIZES . . . ½", ¾", 1", 1¼", 1½", 2"

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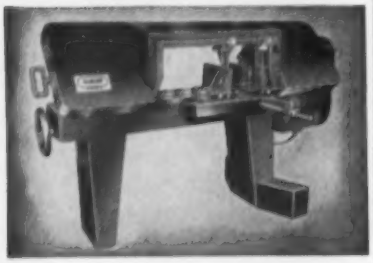

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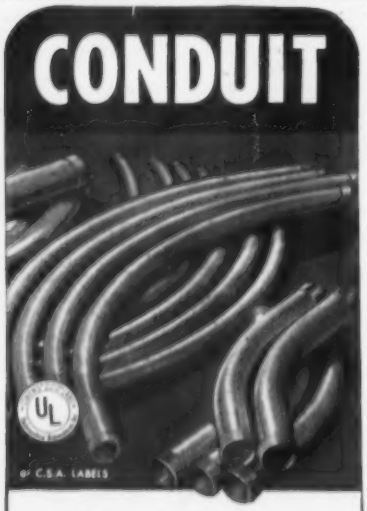

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Among the Manufacturers

Headquarters Announcements

Olin Mathieson Chemical Corp., New York—Stanley W. Koenig, director of advertising.

Gould-National Batteries, Inc., Trenton, N. J.—W. S. Sanderson, manager of education and training, Industrial Division.

Gibson Mfg. Co., Atlanta, Ga.—Guy C. Rhoad, vice president in charge of manufacturing.

C & D Batteries, Inc., Conshohocken, Pa.—John F. Rittenhouse, president; Louis M. Ecle, Jr., vice president; H. Russell Stewart, director; Stewart E. Doughty, treasurer; Wallace M. Schleicher, manager, motive power and railroad sales.

Union Carbide Corp. is new name of Union Carbide and Carbon Corp., New York.

Rockbestos Products Corp., New Haven, Conn.—Richard H. Bamford, sales manager.

Michigan Oven Co., Detroit, Mich.—Ernest R. Meyers, assistant sales manager.

Ramset Fastening System, Cleveland, Ohio—James J. Clarke, sales manager.

Westinghouse Electric Corp., Pittsburgh, Pa.—W. M. McMunn, manager of new Manufactured Products Dept.; E. W. Seay, manager of general advertising; Leonard N. Goodell, manager of electrical products, Sunnyvale Div.; Fenton L. Tippett, manager of mechanical products, Sunnyvale Div.

Harvey Hubbell, Inc., Bridgeport, Conn.—Walter S. Herrstrom, vice president in charge of manufacturing; George A. Hudson, secretary and treasurer. Re-elected: Harvey Hubbell, president, and new chairman of the board; George R. Weppler, vice president and general manager; Jess C. Hicks, vice president in charge of sales.

McGill Mfg. Co. Inc., Valparaiso, Ind.—Ray A. Bouvier, chief engineer, Electrical Div.

Westinghouse Electric Corp., Bloomfield, N. J.—George S. Evans, manager of fluorescent lamp engineering.

Minnesota Mining & Mfg. Co., St. Paul, Minn.—Robert H. Tucker, secretary; Irwin R. Hansen, treas.

Anaconda Wire and Cable Co., New York—David E. Allen, director, in addition to duties as vice president—sales.

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Only Y-ER EAS has all these features

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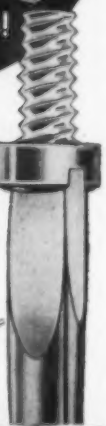

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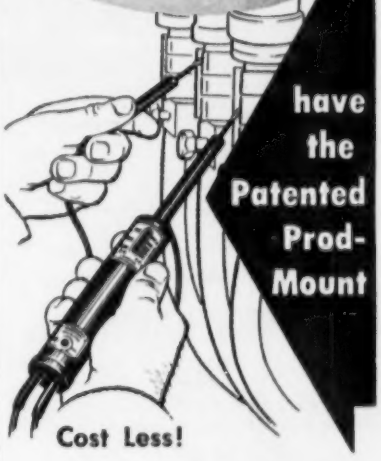

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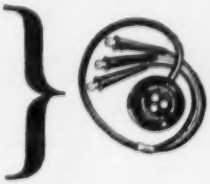

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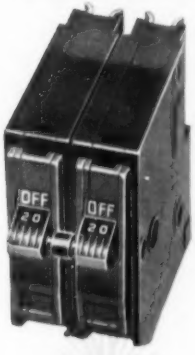

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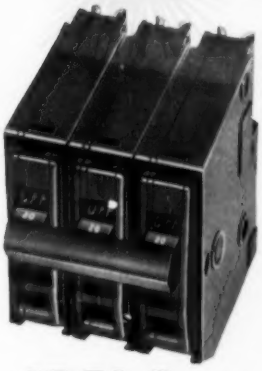

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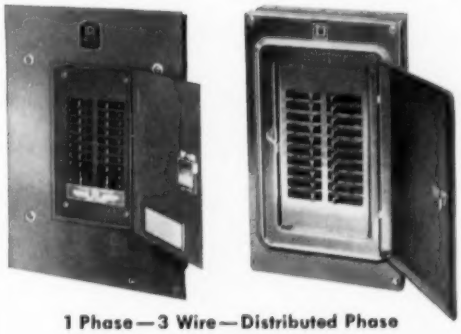

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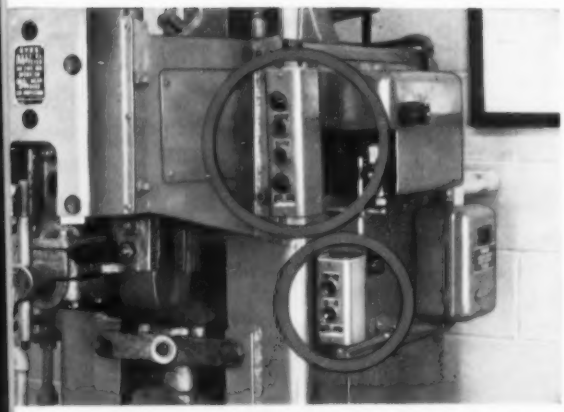

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